

JS 44 (Rev. 12/12)

CIVIL COVER SHEET

The JS 44 civil cover sheet and the information contained herein neither replace nor supplement the filing and service of pleadings or other papers as required by law, except as provided by local rules of court. This form, approved by the Judicial Conference of the United States in September 1974, is required for the use of the Clerk of Court for the purpose of initiating the civil docket sheet. (SEE INSTRUCTIONS ON NEXT PAGE OF THIS FORM.)

I. (a) PLAINTIFFS

Pannell Manufacturing Corp.

(b) County of Residence of First Listed Plaintiff _____

(EXCEPT IN U.S. PLAINTIFF CASES)

(c) Attorneys (Firm Name, Address, and Telephone Number)

Patricia S. Rogowski and Keith A. Jones
Panitch Schwarze, 2005 Market Street, Suite 2200, Philadelphia, PA
19103

DEFENDANTS

Israel Smoker, Katie Smoker, Phillips Mushroom Farms, Inc., Phillips
Mushroom Farms, LP and E&H Conveyors, Inc.

County of Residence of First Listed Defendant _____

(IN U.S. PLAINTIFF CASES ONLY)

NOTE: IN LAND CONDEMNATION CASES, USE THE LOCATION OF
THE TRACT OF LAND INVOLVED.

Attorneys (If Known)

II. BASIS OF JURISDICTION (Place an "X" in One Box Only)

- ☐ 1 U.S. Government Plaintiff
- ☒ 3 Federal Question (U.S. Government Not a Party)
- ☐ 2 U.S. Government Defendant
- ☐ 4 Diversity (Indicate Citizenship of Parties in Item III)

III. CITIZENSHIP OF PRINCIPAL PARTIES (Place an "X" in One Box for Plaintiff and One Box for Defendant)

- | | PTF | DEF | | PTF | DEF |
|---|----------------------------|----------------------------|---|----------------------------|----------------------------|
| Citizen of This State | <input type="checkbox"/> 1 | <input type="checkbox"/> 1 | Incorporated or Principal Place of Business In This State | <input type="checkbox"/> 4 | <input type="checkbox"/> 4 |
| Citizen of Another State | <input type="checkbox"/> 2 | <input type="checkbox"/> 2 | Incorporated and Principal Place of Business In Another State | <input type="checkbox"/> 5 | <input type="checkbox"/> 5 |
| Citizen or Subject of a Foreign Country | <input type="checkbox"/> 3 | <input type="checkbox"/> 3 | Foreign Nation | <input type="checkbox"/> 6 | <input type="checkbox"/> 6 |

IV. NATURE OF SUIT (Place an "X" in One Box Only)

CONTRACT	TORTS	FORFEITURE/PENALTY	BANKRUPTCY	OTHER STATUTES	
<input type="checkbox"/> 110 Insurance <input type="checkbox"/> 120 Marine <input type="checkbox"/> 130 Miller Act <input type="checkbox"/> 140 Negotiable Instrument <input type="checkbox"/> 150 Recovery of Overpayment & Enforcement of Judgment <input type="checkbox"/> 151 Medicare Act <input type="checkbox"/> 152 Recovery of Defaulted Student Loans (Excludes Veterans) <input type="checkbox"/> 153 Recovery of Overpayment of Veteran's Benefits <input type="checkbox"/> 160 Stockholders' Suits <input type="checkbox"/> 190 Other Contract <input type="checkbox"/> 195 Contract Product Liability <input type="checkbox"/> 196 Franchise	PERSONAL INJURY <input type="checkbox"/> 310 Airplane <input type="checkbox"/> 315 Airplane Product Liability <input type="checkbox"/> 320 Assault, Libel & Slander <input type="checkbox"/> 330 Federal Employers' Liability <input type="checkbox"/> 340 Marine <input type="checkbox"/> 345 Marine Product Liability <input type="checkbox"/> 350 Motor Vehicle <input type="checkbox"/> 355 Motor Vehicle Product Liability <input type="checkbox"/> 360 Other Personal Injury <input type="checkbox"/> 362 Personal Injury - Medical Malpractice	PERSONAL INJURY <input type="checkbox"/> 365 Personal Injury - Product Liability <input type="checkbox"/> 367 Health Care/Pharmaceutical Personal Injury Product Liability <input type="checkbox"/> 368 Asbestos Personal Injury Product Liability PERSONAL PROPERTY <input type="checkbox"/> 370 Other Fraud <input type="checkbox"/> 371 Truth in Lending <input type="checkbox"/> 380 Other Personal Property Damage <input type="checkbox"/> 385 Property Damage Product Liability	<input type="checkbox"/> 625 Drug Related Seizure of Property 21 USC 881 <input type="checkbox"/> 690 Other LABOR <input type="checkbox"/> 710 Fair Labor Standards Act <input type="checkbox"/> 720 Labor/Management Relations <input type="checkbox"/> 740 Railway Labor Act <input type="checkbox"/> 751 Family and Medical Leave Act <input type="checkbox"/> 790 Other Labor Litigation <input type="checkbox"/> 791 Employee Retirement Income Security Act IMMIGRATION <input type="checkbox"/> 462 Naturalization Application <input type="checkbox"/> 465 Other Immigration Actions	<input type="checkbox"/> 422 Appeal 28 USC 158 <input type="checkbox"/> 423 Withdrawal 28 USC 157 PROPERTY RIGHTS <input type="checkbox"/> 820 Copyrights <input checked="" type="checkbox"/> 830 Patent <input type="checkbox"/> 840 Trademark SOCIAL SECURITY <input type="checkbox"/> 861 HIA (1395ff) <input type="checkbox"/> 862 Black Lung (923) <input type="checkbox"/> 863 DIWC/DIWW (405(g)) <input type="checkbox"/> 864 SSID Title XVI <input type="checkbox"/> 865 RSI (405(g)) FEDERAL TAX SUITS <input type="checkbox"/> 870 Taxes (U.S. Plaintiff or Defendant) <input type="checkbox"/> 871 IRS—Third Party 26 USC 7609	<input type="checkbox"/> 375 False Claims Act <input type="checkbox"/> 400 State Reapportionment <input type="checkbox"/> 410 Antitrust <input type="checkbox"/> 430 Banks and Banking <input type="checkbox"/> 450 Commerce <input type="checkbox"/> 460 Deportation <input type="checkbox"/> 470 Racketeer Influenced and Corrupt Organizations <input type="checkbox"/> 480 Consumer Credit <input type="checkbox"/> 490 Cable/Sat TV <input type="checkbox"/> 850 Securities/Commodities/Exchange <input type="checkbox"/> 890 Other Statutory Actions <input type="checkbox"/> 891 Agricultural Acts <input type="checkbox"/> 893 Environmental Matters <input type="checkbox"/> 895 Freedom of Information Act <input type="checkbox"/> 896 Arbitration <input type="checkbox"/> 899 Administrative Procedure Act/Review or Appeal of Agency Decision <input type="checkbox"/> 950 Constitutionality of State Statutes
REAL PROPERTY <input type="checkbox"/> 210 Land Condemnation <input type="checkbox"/> 220 Foreclosure <input type="checkbox"/> 230 Rent Lease & Ejectment <input type="checkbox"/> 240 Torts to Land <input type="checkbox"/> 245 Tort Product Liability <input type="checkbox"/> 290 All Other Real Property	CIVIL RIGHTS <input type="checkbox"/> 440 Other Civil Rights <input type="checkbox"/> 441 Voting <input type="checkbox"/> 442 Employment <input type="checkbox"/> 443 Housing/Accommodations <input type="checkbox"/> 445 Amer. w/Disabilities - Employment <input type="checkbox"/> 446 Amer. w/Disabilities - Other <input type="checkbox"/> 448 Education	PRISONER PETITIONS Habeas Corpus: <input type="checkbox"/> 463 Alien Detainee <input type="checkbox"/> 510 Motions to Vacate Sentence <input type="checkbox"/> 530 General <input type="checkbox"/> 535 Death Penalty Other: <input type="checkbox"/> 540 Mandamus & Other <input type="checkbox"/> 550 Civil Rights <input type="checkbox"/> 555 Prison Condition <input type="checkbox"/> 560 Civil Detainee - Conditions of Confinement			

V. ORIGIN (Place an "X" in One Box Only)

- ☒ 1 Original Proceeding ☐ 2 Removed from State Court ☐ 3 Remanded from Appellate Court ☐ 4 Reinstated or Reopened ☐ 5 Transferred from Another District (specify) ☐ 6 Multidistrict Litigation

VI. CAUSE OF ACTION

Cite the U.S. Civil Statute under which you are filing (Do not cite jurisdictional statutes unless diversity):
35 USC § 1 et seq and 35 USC §§ 271, 281-285

Brief description of cause:
Patent Infringement

VII. REQUESTED IN COMPLAINT:

☐ CHECK IF THIS IS A CLASS ACTION UNDER RULE 23, F.R.Cv.P.

DEMAND \$

CHECK YES only if demanded in complaint:

JURY DEMAND: ☒ Yes ☐ No**VIII. RELATED CASE(S) IF ANY**

(See instructions):


JUDGE _____

DOCKET NUMBER _____

DATE

12/02/2016

SIGNATURE OF ATTORNEY OF RECORD



FOR OFFICE USE ONLY

RECEIPT # _____

AMOUNT _____

APPLYING IFP _____

JUDGE _____

MAG. JUDGE _____

**UNITED STATES DISTRICT COURT FOR
THE EASTERN DISTRICT OF PENNSYLVANIA**

PANNELL MANUFACTURING CORP.,

Plaintiff,

v.

**ISRAEL SMOKER; KATIE SMOKER;
PHILLIPS MUSHROOM FARMS, INC.;
PHILLIPS MUSHROOM FARMS, L.P.;
and E&H CONVEYORS, INC.,**

Defendants.

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Civ. Action No. 16-CV-_____

JURY TRIAL DEMANDED

COMES NOW, the plaintiff, Pannell Manufacturing Corp. (“Pannell” or “Plaintiff”) by and through its undersigned counsel, and for its complaint against defendants Israel Smoker and Katie Smoker (“the Smoker Defendants”), Phillips Mushroom Farms, Inc., Phillips Mushroom Farms, L.P. (jointly, “Phillips”), and E&H Conveyors, Inc. (“E&H”) (collectively, “Defendants”), alleges as follows:

NATURE OF ACTION

1. This is an action for patent infringement against Defendants for their infringement of U.S. Patent Nos. 8,069,608 (“the ‘608 patent”), 8,205,379 (“the ‘379 patent”) and 8,561,344 (“the ‘344 patent”) (collectively, “the Pannell Patents”).

PARTIES

2. Plaintiff Pannell Manufacturing Corp. is a corporation organized and existing under the laws of the Commonwealth of Pennsylvania, with its corporate headquarters and principal place of business at 1780 Baltimore Pike, Avondale, Pennsylvania 19311.

3. Upon information and belief, Defendants Israel and Katie Smoker are individuals doing business as Smoker Manufacturing, with residences at 415 Jackson School Rd, Oxford,

Pennsylvania 19363.

4. Upon information and belief, Defendant Phillips Mushroom Farms, Inc. is a corporation organized under the laws of the Commonwealth of Pennsylvania, with its headquarters and principal place of business located at 1011 Kaolin Rd., Kennett Square, Pennsylvania 19348.

5. Upon information and belief, Defendant Phillips Mushroom Farms, L.P. is a limited partnership organized under the laws of the Commonwealth of Pennsylvania, with its headquarters and principal place of business located at 1011 Kaolin Rd., Kennett Square, Pennsylvania 19348.

6. Upon information and belief, Defendant E&H Conveyors, Inc. is a corporation organized under the laws of the Commonwealth of Pennsylvania, with its headquarters and principal place of business located at 1201 Reedville Rd, Oxford, Pennsylvania 19363.

JURISDICTION AND VENUE

7. This action arises under the United States Patent Act, codified at 35 U.S.C. § 1 et seq., and in particular, 35 U.S.C. §§ 271 and 281-285.

8. This Court has original jurisdiction over the subject matter of this action under 28 U.S.C. §§ 1331 and 1338(a).

9. This Court has personal jurisdiction over Defendants because, on information and belief, Defendants' residence (as to the Smoker Defendants) and Defendants' principal places of business are in this Judicial District. This Court also has personal jurisdiction over Defendants because, on information and belief, Defendants have committed acts of infringement in and from this Judicial District, and continue to commit acts of infringement in and from this Judicial District.

10. Venue is proper under 28 U.S.C. §§ 1391(b), 1391(c) and 1400(b) in this District because, on information and belief, Defendants' residence (as to the Smoker Defendants) and Defendants' principal places of business are in this District. Venue is also proper in this District because, on information and belief, Defendants have committed acts of infringement in and from this District, and continue to commit acts of infringement in and from this District.

FACTUAL BACKGROUND

11. Plaintiff has extensive experience in developing various tools and machines for use in mushroom farming.

12. On October 12, 2010, Robert T. Pannell filed U.S. Patent Application No. 12/902,523 ("the '523 application"). On October 11, 2010, Mr. Pannell assigned his interest in the '523 application to Plaintiff, and the assignment was recorded in the United States Patent and Trademark Office ("PTO") on October 12, 2010 at Reel 025124, beginning at frame 0722.

13. On December 6, 2011, the PTO issued the '523 application as U.S. Patent No. 8,069,608. A copy of the '608 patent is attached hereto as Exhibit A and is incorporated by reference as if fully set forth herein.

14. The '608 patent is valid and enforceable. The term of the '608 patent will expire on or about October 12, 2030.

15. On December 1, 2011, Robert T. Pannell filed U.S. Patent Application No. 13/309,071 ("the '071 application"). The '071 application claims priority to the '523 application. On October 11, 2010, Mr. Pannell assigned his interest in the '071 application to Plaintiff, and the assignment was recorded in the PTO on December 1, 2011 at Reel 027307, beginning at frame 0053.

16. On June 26, 2012, the PTO issued the '071 application as U.S. Patent No. 8,205,379. A copy of the '379 patent is attached hereto as Exhibit B and is incorporated by reference as if fully set forth herein.

17. The '379 patent is valid and enforceable. The term of the '379 patent will expire on or about October 12, 2030.

18. On December 10, 2012, Robert T. Pannell filed U.S. Patent Application No. 13/709,105 ("the '105 application"). The '105 application claims priority to the '071 and 523 applications. On October 11, 2010, Mr. Pannell assigned his interest in the '105 application to Plaintiff, and the assignment was recorded in the PTO on December 10, 2012 at Reel 029433, beginning at frame 0744.

19. On October 22, 2013, the PTO issued the '105 application as U.S. Patent No. 8,561,344. A copy of the '344 patent is attached hereto as Exhibit C and is incorporated by reference as if fully set forth herein.

20. The '344 patent is valid and enforceable. The term of the '344 patent will expire on or about October 12, 2030.

21. The Pannell patents disclose and claim systems and methods for compacting mushroom compost using a roller assembly mounted to a compost receptacle to form a nip, along with a web or conveyor to convey mushroom compost to and through the nip. With the patented systems, mushroom compost is compacted to a particular height that can be adjusted by the user through adjustment of the space between the roller and the compost receptacle.

22. Plaintiff is the assignee of all right, title, and interest in the Pannell patents and possesses all rights of recovery under them, including the right to sue for infringement, recourse for damages, and to seek injunctive relief.

23. Upon information and belief, for all times relevant to this Complaint, the Smoker Defendants have manufactured, and Defendant E&H has assembled, installed and used, a mushroom compost compacting system (“the Accused Product”) in mushroom houses owned and operated by Defendant Phillips that is covered by one or more of the claims of each of the Pannell patents. The Accused Product continues to be used in mushroom houses owned and operated by Defendant Phillips to this day.

24. The Accused Product was discovered by Plaintiff at Defendant Phillips’s premises within this Judicial District on or about September 12, 2016. Several photographs of the Accused Product are attached hereto as Exhibit D.

COUNT I
INFRINGEMENT OF THE ‘608 PATENT

25. Plaintiff realleges and incorporates by reference paragraphs 1 through 24 of this Complaint as though fully set forth herein.

26. The claims of the ‘608 patent are presumed valid pursuant to 35 U.S.C. § 282.

27. Upon information and belief, Defendants have been and are currently infringing one or more claims of the ‘608 patent, either literally or under the doctrine of equivalents, by making, causing to be made, using, offering to sell, or selling, without license or authority, at least the Accused Product, which is covered by one or more of the claims of the Pannell patents, including at least claim 1 of the ‘608 patent. Upon information and belief, the Accused Product includes a roller assembly mountable to a compost receptacle. The roller assembly of the Accused product includes a roller that rotates around a shaft and a fixture at each end of the shaft, each fixture capable of having its height adjusted with respect to the distance between the roller and the floor of the compost receptacle and having an end coupled to the end of the shaft, a middle portion mountable to a sidewall of the compost receptacle, and another end mountable to

a support of the compost receptacle. The Accused Product when installed onto the compost receptacle, in combination with the compost receptacle, further includes a web to convey mushroom compost into the area between the roller and the floor of the compost receptacle.

28. As a result of Defendants' infringement of the '608 patent, Plaintiff has been damaged to an extent not yet determined.

29. Plaintiff is entitled to monetary damages adequate to compensate it for infringement by Defendants of the '608 patent, together with interest and costs.

COUNT II
INFRINGEMENT OF THE '379 PATENT

30. Plaintiff realleges and incorporates by reference paragraphs 1 through 29 of this Complaint as though fully set forth herein.

31. The claims of the '379 patent are presumed valid pursuant to 35 U.S.C. § 282.

32. Upon information and belief, Defendants have been and are currently infringing one or more claims of the '379 patent, either literally or under the doctrine of equivalents, by making, causing to be made, using, offering to sell, or selling, without license or authority, at least the Accused Product, which is covered by one or more of the claims of the Pannell patents, including at least claim 1 of the '379 patent. Upon information and belief, the Accused Product, when installed on a mushroom compost receptacle, is capable of performing a method of introducing mushroom compost onto a web on a floor of the mushroom compost receptacle, wherein the Accused Product includes a roller assembly mountable to the compost receptacle. The roller assembly of the Accused product includes a roller that rotates around a shaft and a fixture at each end of the shaft, each fixture capable of having its height adjusted with respect to the distance between the roller and the floor of the compost receptacle and having an end coupled to the end of the shaft, a middle portion mountable to a sidewall of the compost

receptacle, and another end mountable to a support of the compost receptacle. Using these instrumentalities, the claimed method is carried out by feeding the mushroom compost and web through the space between the roller and the floor of the compost receptacle.

33. As a result of Defendants' infringement of the '379 patent, Plaintiff has been damaged to an extent not yet determined.

34. Plaintiff is entitled to monetary damages adequate to compensate it for infringement by Defendants of the '379 patent, together with interest and costs.

COUNT III
INFRINGEMENT OF THE '344 PATENT

35. Plaintiff realleges and incorporates by reference paragraphs 1 through 34 of this Complaint as though fully set forth herein.

36. The claims of the '344 patent are presumed valid pursuant to 35 U.S.C. § 282.

37. Upon information and belief, Defendants have been and are currently infringing one or more claims of the '344 patent, either literally or under the doctrine of equivalents, by making, causing to be made, using, offering to sell, or selling, without license or authority, at least the Accused Product, which is covered by one or more of the claims of the Pannell patents, including at least claims 1 and 7 of the '344 patent. Upon information and belief, the Accused Product includes a roller assembly mountable to a compost receptacle. The roller assembly of the Accused product includes a roller that rotates around a shaft and a fixture at each end of the shaft, each fixture capable of having its height adjusted with respect to the distance between the roller and the floor of the compost receptacle and having an end coupled to the end of the shaft, a middle portion mountable to a sidewall of the compost receptacle, and another end mountable to a support of the compost receptacle. The Accused Product when installed onto the compost

receptacle, in combination with the compost receptacle, further includes a web to convey mushroom compost into the area between the roller and the floor of the compost receptacle.

38. As a result of Defendants' infringement of the '344 patent, Plaintiff has been damaged to an extent not yet determined.

39. Plaintiff is entitled to monetary damages adequate to compensate it for infringement by Defendants of the '344 patent, together with interest and costs.

JURY DEMAND

Plaintiff hereby demands a jury trial on all issues appropriately triable by jury.

PRAYER FOR RELIEF

WHEREFORE, Plaintiff Pannell Manufacturing Corp. prays for judgment in its favor and against defendants Israel Smoker, Katie Smoker, Phillips Mushroom Farms, Inc., Phillips Mushroom Farms, L.P., and E&H Conveyors, Inc. for the following:

- (a) A judgment that Defendants have infringed the Pannell patents;
- (b) An award to Plaintiff of damages that are adequate to fully compensate it for Defendants' infringement of the Pannell patents, together with prejudgment interests and costs;
- (c) A permanent injunction enjoining Defendants and those in active concert or participation therewith from infringing the Pannell patents;
- (d) A finding that this case is exceptional and award Plaintiff its costs, reasonable attorneys' fees, and expenses incurred in this action;
- (e) An accounting for damages from the infringement of the Pannell patents by Defendants (and those in privity with Defendants), including but not limited to those sales not presented at trial and an award by the Court for any such sales; and

(f) An award of such other and further relief, at law or in equity, as the Court may deem just and proper.

Dated: December 5, 2016

PANITCH SCHWARZ BELISARIO & NADEL, LLP

By: /s/ Keith Jones

Keith Jones (Bar No. 313,116)

Patricia Smink Rogowski (Bar No. 52,072)

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kjones@panitchlaw.com

Attorneys for Plaintiff Pannell Manufacturing Corp.

Exhibit A



US008069608B1

(12) **United States Patent**
Pannell

(10) **Patent No.:** **US 8,069,608 B1**
(45) **Date of Patent:** **Dec. 6, 2011**

(54) **MUSHROOM COMPOST COMPACTING SYSTEM AND METHOD**

(75) **Inventor:** **Robert T. Pannell, Kennett Square, PA (US)**

(73) **Assignee:** **Pannell Manufacturing Corp, Avondale, PA (US)**

(*) **Notice:** Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) **Appl. No.:** **12/902,523**

(22) **Filed:** **Oct. 12, 2010**

(51) **Int. Cl.**
A01G 1/04 (2006.01)

(52) **U.S. Cl.** **47/1.1**
(58) **Field of Classification Search** **47/1.1, 47/18, 58.1 R, 58.1 FV, FOR. 100, DIG. 10; 100/152, 102, 153, 210, 155 R, 168, 100; 404/103**

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

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* cited by examiner

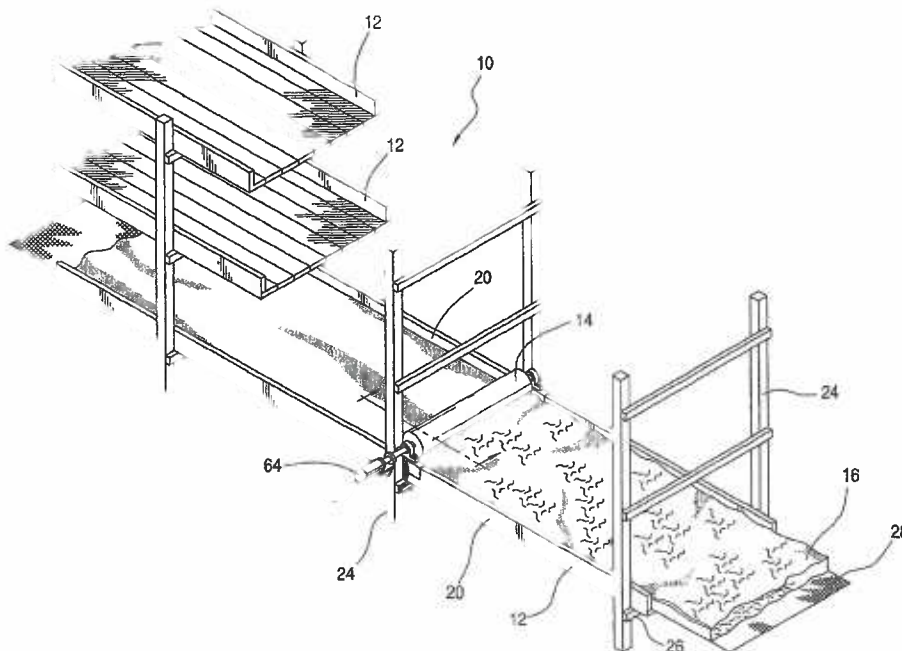
Primary Examiner — T. Nguyen

(74) *Attorney, Agent, or Firm* — Connolly Bove Lodge & Hutz LLP

(57) **ABSTRACT**

A mushroom compost compacting system and method includes a roller assembly mounted to a compost receptacle to form a nip, and a web or conveyor to convey mushroom compost to the nip. Mushroom compost is compacted at the nip from an initial compost height to a final compost height. The roller assembly has a roller, a shaft, and fixtures coupled to each end of the shaft. The fixtures are adjustable to define the roller nip height. In one embodiment, the fixtures are mounted to sleeves that engage the sidewalls of the compost receptacle. In another embodiment, the ends of the fixtures are mounted to a support, which may be a joist or a separate channel extending under the floor portion of the compost receptacle, or which may be a post that forms support structure for the compost receptacle.

6 Claims, 4 Drawing Sheets

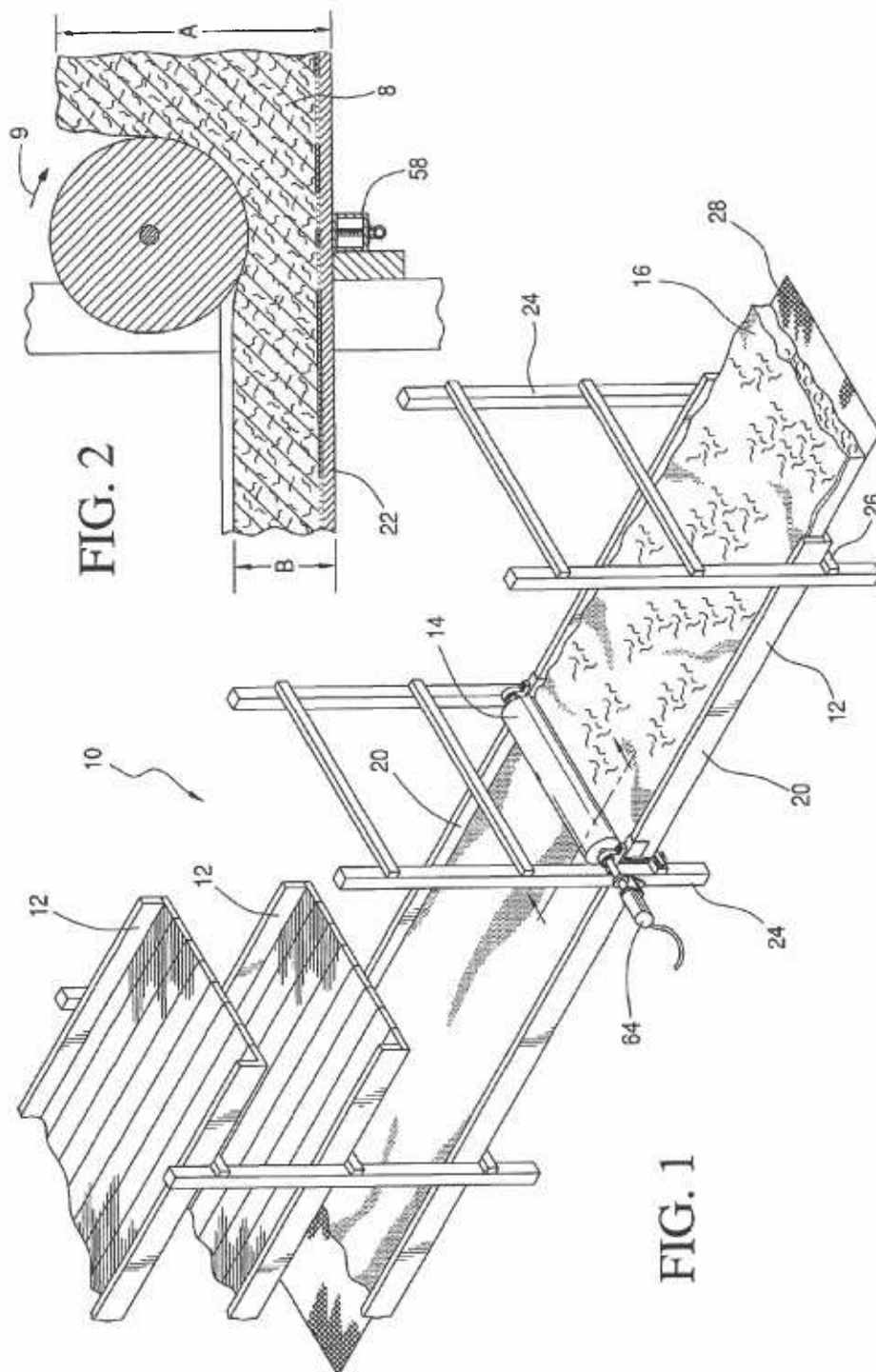


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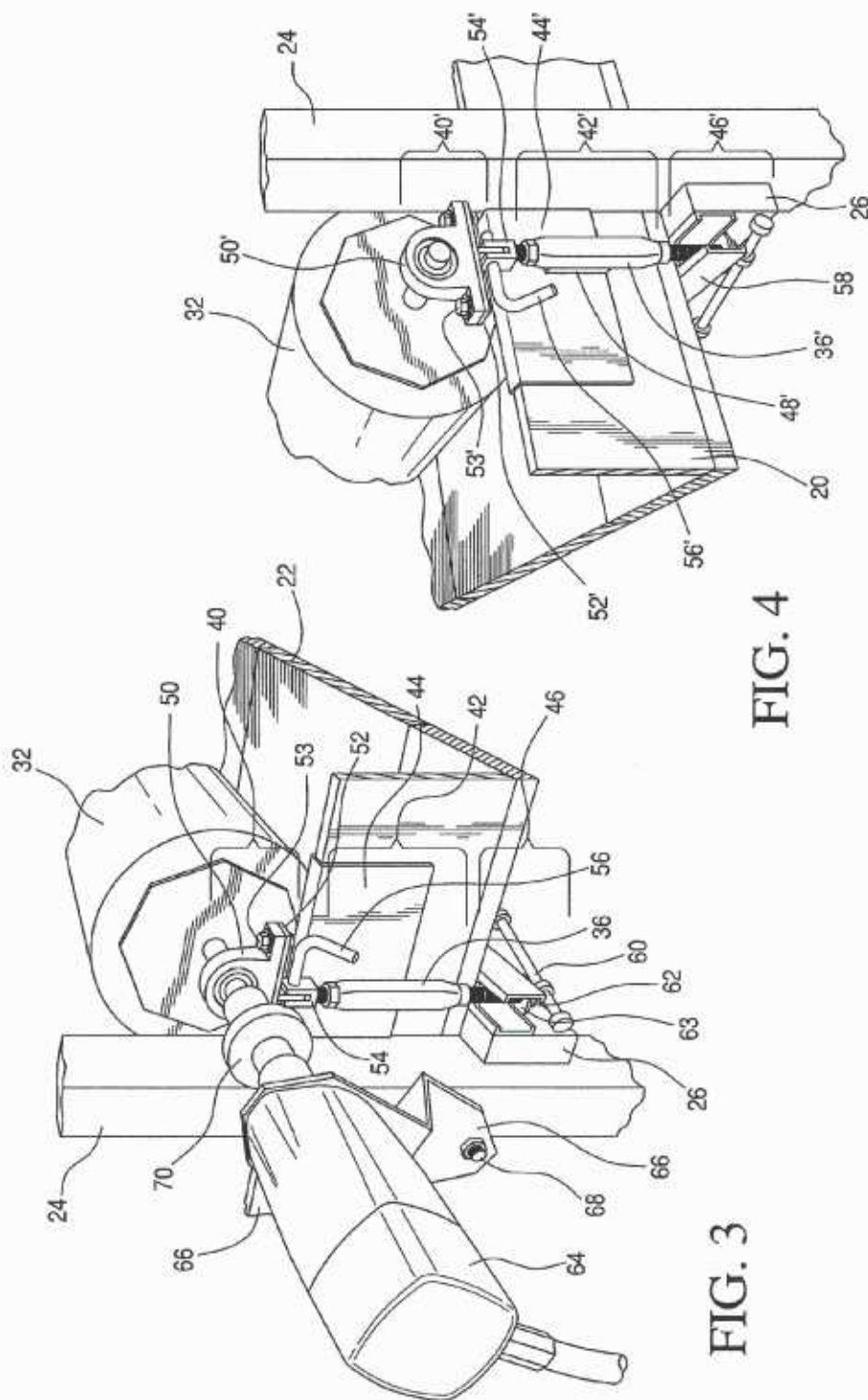


FIG. 4

FIG. 3

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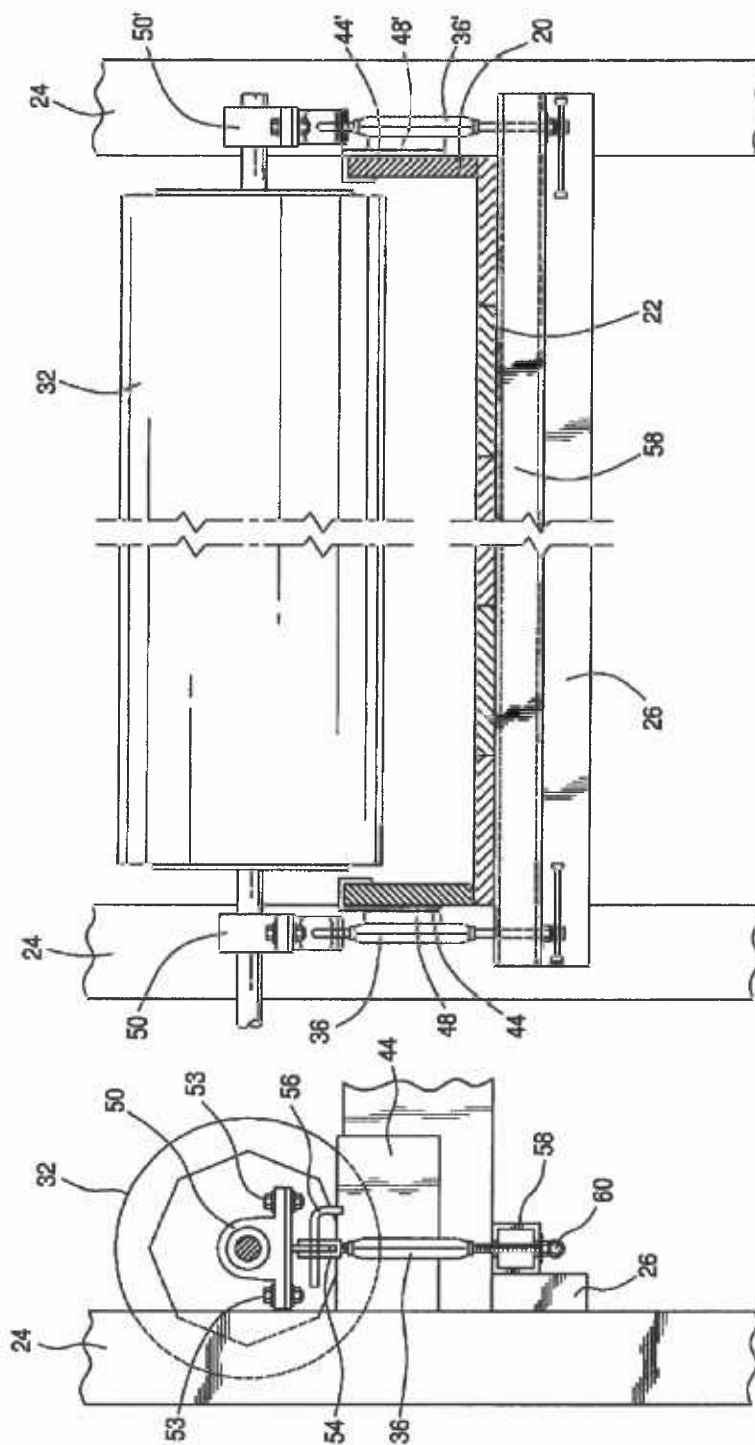


FIG. 6

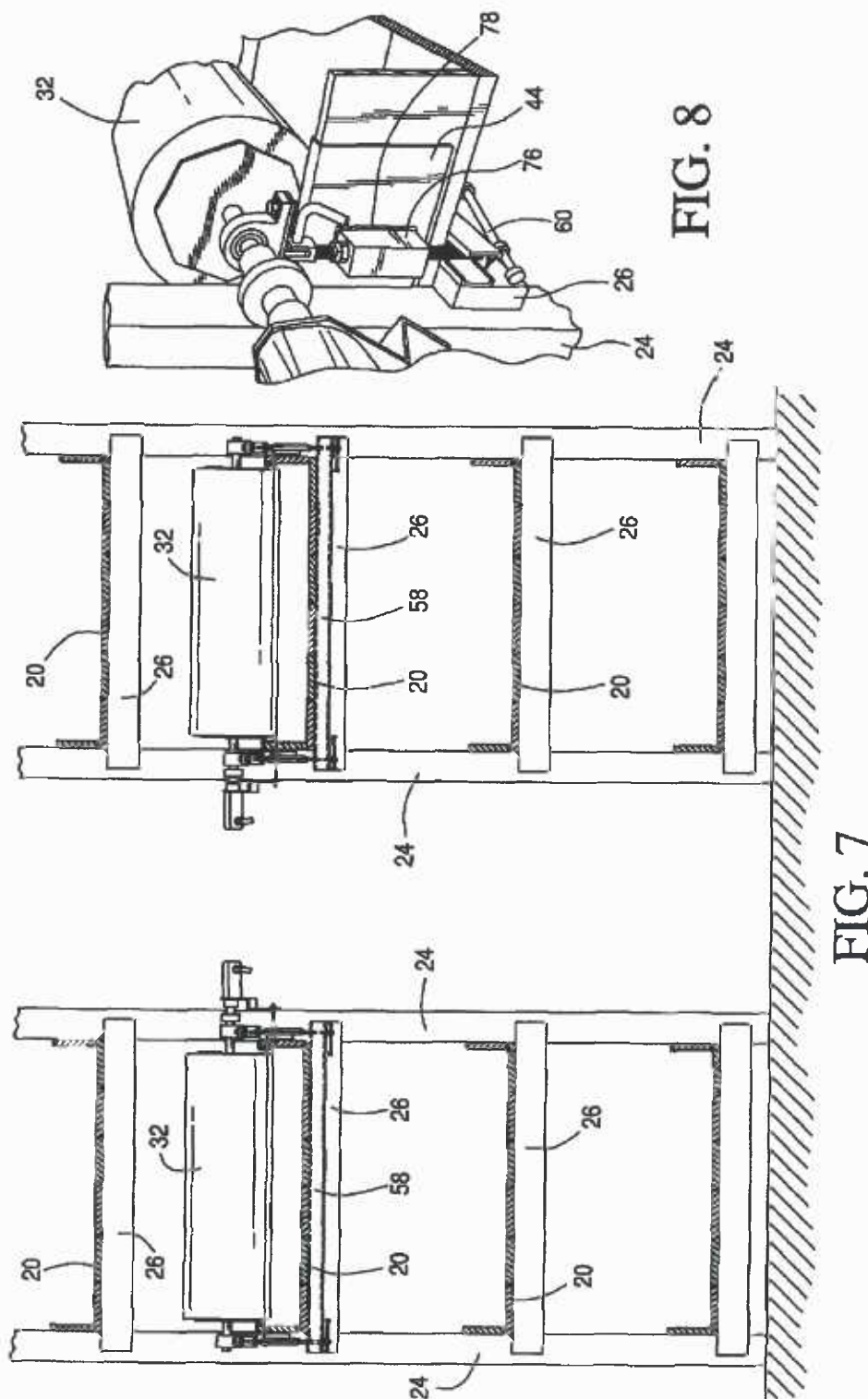
FIG. 5

U.S. Patent

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US 8,069,608 B1

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**MUSHROOM COMPOST COMPACTING
SYSTEM AND METHOD****BACKGROUND OF THE INVENTION****1. Field of the Invention**

The field of the invention is mushroom compost compacting systems, and particularly those systems for composting Phase II or Phase III mushroom composts.

2. Background

Mushroom farming comprises generally six steps: (1) Phase I composting; (2) Phase II composting; (3) spawning; or (2a/3a) Phase III composting; (4) casing; (5) pinning; and (6) cropping. The most used and least expensive mushroom compost is straw-bedded horse manure to which nitrogen supplements and a conditioning agent, such as gypsum, are added. After the compost ingredients have been mixed, watered and aerated in Phase I for a requisite number of days, the compost is pasteurized in Phase II. Pasteurization kills insects, unwanted fungi or other pests that may be present in the compost.

Preparing Phase II mushroom compost can be difficult. One reason for the apparent difficulty with this phase is that pasteurization can last up to two weeks, depending upon the production system used. The time required, as well as other difficulties in maintaining temperature control and eliminating pests during this phase have led many mushroom farmers to purchase pre-pasteurized compost. In many cases, the Phase II compost is pre-mixed with mushroom spawn. Alternatively, Phase III compost is pasteurized, pre-mixed with mushroom spawn and spawn run.

When commercial mushroom farmers purchase pre-pasteurized Phase II or Phase III composts, proper compaction of mushroom beds is still necessary to spawn and grow mushrooms. Moreover, regardless the type of receptacle in which the compost is stored during processing, uniform compaction and density of the compost is beneficial for mushroom cultivation. For maximum yield, mushroom beds should have Phase II and Phase III compost density and compaction that fosters gas exchange, keeps compost temperatures sufficiently low, and prevents spawn kill in the next phase of processing.

Presently, commercial mushroom farmers who purchase pre-pasteurized compost introduce the Phase II or Phase III compost into beds by conveyor and attempt to use spawning machines to compact the compost. These machines, however, are not designed to compact to the degree desired for mushroom cultivation. Furthermore, these machines are less than desirable for commercial mushroom farmers because during operation they also chop up the spawn incorporated into the compost, potentially interfering with the next step in mushroom farming.

Other known compacting systems and methods are impractical for commercial use. One such system uses an assembly with rollers and smoothing plates. In this system, mushroom compost is partially compacted after placement into the mushroom bed. The assembly is then horizontally positioned over the bed and manually guided by two operators located on each side of the bed. This system tends to compact only a surface layer portion of the bed. Compaction to some degree has also been performed by hand after placement of compost in the bed. These time-consuming manual systems and methods make clear the need for improved mushroom compaction systems.

While certain aspects of prior art mushroom compacting systems have been discussed, aspects of these systems are in

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no way disclaimed and it is contemplated that the claimed invention may encompass one or more aspects of the prior art devices discussed herein.

SUMMARY OF THE INVENTION

The present invention is directed toward a mushroom compost compacting system and method. In one embodiment, the system comprises a roller assembly mounted to a compost receptacle, and a web, all of which are configured to compact mushroom compost from an initial compost height to a final compost height. The compost receptacle is configured to receive mushroom compost from any source.

The roller assembly includes a roller, a shaft, and two fixtures to removably mount or affix the roller and shaft to the compost receptacle. The roller is mounted for rotation on the shaft, such as by a through-hole for receiving the shaft. The fixtures are coupled to the shaft for height adjustment of the roller and the shaft in relation to the floor portion of the compost receptacle. Each fixture has (a) a first end that is coupled to one respective end of the shaft, (b) a mid-section that is coupled to a sleeve that seats over a sidewall of the compost receptacle, and (c) a second end that is adapted to mount to a support onto the compost receptacle. The sleeve that is coupled to the mid-section of the fixture is adapted to removably mount onto the sidewalls of the compost receptacle.

The web or liner or conveyor included in the mushroom compacting system is adapted to move under the roller to convey compost to the nip. As the web or liner or conveyor moves under the roller, the mushroom compost is compacted from an initial compost height to a final desired compost height.

Accordingly, a mushroom compacting system and method are disclosed. Advantages of the system and method will appear from the drawings and following description.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention described above will be explained in greater detail below on the basis of embodiments and with reference to the accompanying drawings in which:

FIG. 1 is a top perspective view of a mushroom compost bed with a mushroom composting system;

FIG. 2 is a cross-sectional view of the mushroom composting system shown in FIG. 1 taken along line 2-2 in FIG. 1;

FIG. 3 is a left side partial perspective view of a roller assembly;

FIG. 4 is a right side partial perspective view of the roller assembly of FIG. 3;

FIG. 5 is a right side view of the roller assembly;

FIG. 6 is a broken front elevation view of the roller assembly;

FIG. 7 is a right side view of two roller assemblies operably attached to two mushroom compost beds; and

FIG. 8 is a right side view of an alternative fixture for a roller assembly.

**DETAILED DESCRIPTION OF THE PREFERRED
EMBODIMENTS**

Turning in detail to the drawings, FIG. 1. illustrates a mushroom compost bed 10 that includes a series of trays or shelves, herein compost receptacles 12, into each of which mushroom compost 8 is deposited or laid. The mushroom compost 8 may be Phase I, Phase II or Phase III compost. Phase II compost may be pre-spawned, and Phase III compost

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may be spawn run. The compost receptacle 12 may be any geometric configuration suitable to house mushroom compost 8. In one configuration as shown in FIG. 1, the compost receptacle 12 is an elongated bin, tray, or shelf that has two endwalls 18 (not shown), two sidewalls 20, and a bottom 22. The bottom may be a series of slats or decking running generally lengthwise. Each compost receptacle 12 is supported by vertical posts or members 24 positioned at each corner of the compost receptacle 12 and optionally at intervals along the length of the compost receptacle 12. The vertical posts or members 24 may act as supporting legs for one or more compost receptacles 12. As shown in FIG. 1, the vertical posts or members 24 extend vertically to support other compost receptacles (three tiers shown in FIG. 1). These types of multi-tiered compost receptacles are typical in commercial mushroom farming. For additional support, some compost receptacles also have horizontal members or joists 26 that may be mounted to or connected to the vertical members 24 and extend under the floor portion of the compost receptacle 12. Typically, the compost receptacles 12 are wooden, although any suitable material may be used, including, but not limited to plastic, metal, and composite materials.

The mushroom compost 8 is initially placed into the compost receptacle 12 from any suitable source. Preferably, the mushroom compost 8 is distributed inside the compost receptacle 12 along the length of the compost receptacle using a conveyor system (not shown) that acts on the web or conveyor or liner 28. In one type of conveyor system, at one end of the compost receptacle 12, compost is placed on top of the flexible web or conveyor or liner 28 in the bottom 22 of the compost receptacle 12 at a proximal end thereof. The liner 28 is then pulled from the opposite distal end of the compost receptacle 12, such that the compost 8 is distributed or spread along the length of the compost receptacle 12. Examples of suitable materials for the liner include woven fabrics with a plastic or Teflon coating, or may be polyester.

A mushroom compost compacting system 11 includes a roller assembly 14 that is removably affixed to the compost receptacle 12. Each roller assembly 14 comprises a roller 32, a shaft 34, and two fixtures 36, 36'. The shaft 34 and roller 32 extend laterally over the tray portion of the compost receptacle 12. The roller 32 may be made from a lightweight material such as plastic or aluminum, or may be made of another metal lined on its outer surface with a nylon or Teflon or other sheeting. The roller surface is smooth such that the mushroom compost to be compacted by the roller may move easily under the roller 32. In one embodiment, the diameter of roller 32 is from about 8 to 20 inches. The shaft 34 may be formed of steel; however, any material suitable to support the weight of the roller 32 may be used.

As shown in FIGS. 3, 5 and 6, the first fixture 36 includes a first end 40, a mid-section 42 coupled to a sleeve 44, and a second end 46. The first fixture 36 is coupled at one end 40 to one shaft end 38 at pillow block bearing 50 and is coupled at the opposite end 62 to a support 58, such as a channel member. The pillow block bearing 50 is then mounted onto a mounting bracket or plate 52, using bolts 53 or other suitable fasteners. The mounting bracket or plate 52 is then welded to a first mounting element 54 which is threaded to the mid-section 42. Disposed within the first mounting element 54 is a pin 56 which may be rotated for adjustment of the first end 40, such that height adjustment of the roller 32 and shaft 34 is possible for compaction of the mushroom compost. As an example, the nip height between the outer circumferential surface of the roller and the floor of the compost receptacle

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may be from about 2 to about 8 inches. The nip height is set at a distance that is less than the desired compacted height of the mushroom compost.

The mid-section 42 of first fixture 36 may be joined by a spacer 48 or may be welded to a sleeve 44 that is removably mounted or seated or engaged onto a first sidewall 20 of the compost receptacle 12. The second end 42 of the first fixture 36 is threaded to engage the mid-section 42 and to mount onto the compost receptacle 12. Preferably, the second end or opposite end of the first fixture 36 is joined to or mounted to a support, such as channel member 58, that abuts joist or horizontal member 26. In one embodiment, the channel member 58 is a square hollow pipe with a length sufficient to extend under the compost receptacle, and the dimensions of such square may be from 2 inches to 6 inches. In another embodiment, the support may also comprise a solid pipe of suitable cross-sectional shape as desired. The second end 46 is further coupled to a handle element 60 to allow for adjustment of the second end 46. For additional adjustment of the second end 42, washer(s) 63 may be placed between the channel member 58 and the handle element 60.

Referring next to FIGS. 4 and 6, the second fixture 36' may be joined by spacer 48' or may be welded to a sleeve 44'. The second fixture 36' is coupled at one end 40' to one shaft end 38 at pillow block bearing 50' and is coupled at the opposite end 62' to a support 58, such as a channel member. The pillow block bearing 50' is then mounted onto a mounting bracket or plate 52', using bolts 53 or other suitable fasteners. The plate 52' is then welded to a first mounting element 54' which is threaded to the mid-section 42'. Disposed within the first mounting element 54' is a pin 56' which may be rotated for adjustment of the first end 40'.

In an alternative embodiment, however, the second end of the first fixture 36 and the second end of the second fixture 36' are mounted directly to the compost receptacle 12, such as to post 24 or to joist 26 (not shown).

The roller shaft may be turned by hand. Preferably, the first end of the shaft 34 is coupled to a motor 64 for rotation of the roller 32. As shown in FIG. 3, the motor 64 is mounted to a vertical post 24 of the compost receptacle 12 using a mounting plate 66. Adjustment of the mounting plate 66 is achieved through use of a pin 68 that is threaded to the mounting plate 66. Suitable motors include electric and hydraulic motors rated at 1 to 5 HP, or higher HP, although any motor with sufficient capacity to rotate shaft 34 may be used.

The first and second fixtures 36, 36' may be formed from shaped metal, such as steel; however, other materials with sufficient strength to support the roller 32 and shaft 34 may be used.

Once installed, the mushroom compacting system 11 compacts mushroom compost from a first height A to a compacted height B as illustrated in FIG. 2. Gauge boards (not shown) can be inserted adjacent to the side walls of the compost receptacle 12 to help workers place a quantity of mushroom compost onto the conveyor, web or liner 28 at a desired height at one end of the compost receptacle. The roller 32 is rotated in the direction of arrow 9 and the conveyor, web or liner 28 conveys mushroom compost laid thereon to the nip between the roller 32 and the floor portion of the compost receptacle 12. The mushroom compost compacting system 11 can be used with pre-spawned Phase II compost or spawn run Phase III compost without adversely impacting the mushroom crop. As one example, the height A may be about 15 to 16 inches and the height B may be about 6 to 9 inches. A successful degree of compaction is determined at the mushroom grower's discretion. The mushroom compacting system 11 pro-

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vides means to obtain a more uniform compaction of the mushroom compost at the top, middle and bottom portions of the compacted compost bed.

Upon completing compaction of compost to a desired thickness within a first bin or tray of a mushroom compost bed 10, the mushroom compacting system 11 may be detached from the sidewalls 20 of the compost receptacle 12 and attached to another bin or tray.

As shown in FIG. 7, the mushroom compacting system 11 can include multiple roller assemblies 14 operating concurrently on separate trays or shelves or compost receptacles 12 of one or more compost beds 10, 10'. Each roller assembly 14 is portable, and may be easily disassembled and re-installed to other areas along the length of a compost receptacle 12 or to other trays positioned above or below a first compost receptacle 12 of a compost bed 10. Compost beds may include six or seven compost receptacles 12 mounted in stacked relation. After a lower compost receptacle is prepared and compacted, the next highest compost receptacle may be installed and prepared and compacted for growing mushrooms.

An alternative construction of a fixture 76 is shown in FIG. 8. The fixture 76 is welded at weld seam 78 to the sleeve 44. The fixture 76 may be formed with thicker sidewalls than the fixtures 36, 36' in FIGS. 1-7, and has a generally square configuration in cross-section.

A properly compacted mushroom compost bed using the mushroom compacting system according to the invention can shorten the mushroom grow time cycle by one or two days. The system not only expedites mushroom bed preparation with Phase II or Phase III compost, but also produces a more consistent compost compaction that can lead to enhanced yield in a shorter grow time cycle.

While embodiments of this invention have been shown and described, it will be apparent to those skilled in the art that many more modifications are possible without departing from the inventive concepts herein. The invention, therefore, is not to be restricted except in the spirit of the following claims.

What is claimed is:

1. A mushroom compost compacting system, comprising: at least one roller assembly coupled to a compost receptacle having mushroom compost therein, wherein the at least one roller assembly comprises: a roller adapted for rotation on a shaft;

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a first fixture coupled to a first end of the shaft, wherein the first fixture is adapted for height adjustment of the roller and the shaft in reference to a floor portion of the compost receptacle to create a nip between the roller and the floor portion of the compost receptacle, wherein the first fixture comprises:

a first end coupled to the first end of the shaft, a mid-section coupled to a sleeve, wherein the sleeve is adapted to mount onto a first sidewall of the compost receptacle, and a second end adapted to mount onto a support of the compost receptacle;

a second fixture coupled to a second end of the shaft, wherein the second fixture is adapted for height adjustment of the roller and the shaft in reference to the floor portion of the compost receptacle, wherein the second fixture comprises:

a first end coupled to the second end of the shaft; a mid-section coupled to a second sleeve, wherein the second sleeve is adapted to mount onto a second sidewall of the compost receptacle, and a second end adapted to mount onto the support of the compost receptacle; and

a web adapted to convey the mushroom compost into the nip between the roller and the floor portion of the compost receptacle.

2. The mushroom compost compacting system of claim 1, wherein the nip is from about 6 to about 9 inches.

3. The mushroom compost compacting system of claim 1, wherein the support is a channel member positioned under the floor portion of the compost receptacle, and coupled to the second end of the first fixture and the second end of the second fixture.

4. The mushroom compost compacting system of claim 1, wherein the support is a joist supporting the floor portion of the compost receptacle.

5. The mushroom compost compacting system of claim 1, wherein the support is a post associated with the compost receptacle.

6. The mushroom compost compacting system of claim 1, further comprising a motor coupled to the shaft for rotation of the roller.

* * * * *

Exhibit B



US008205379B2

(12) **United States Patent**
Pannell

(10) **Patent No.:** **US 8,205,379 B2**
(45) **Date of Patent:** **Jun. 26, 2012**

(54) **MUSHROOM COMPOST COMPACTING SYSTEM AND METHOD**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **13/309,071**

(22) Filed: **Dec. 1, 2011**

(65) **Prior Publication Data**

US 2012/0085251 A1 Apr. 12, 2012

Related U.S. Application Data

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(51) **Int. Cl.**
A01G 1/04 (2006.01)

(52) **U.S. Cl.** **47/1.1**

(58) **Field of Classification Search** 100/152, 100/102, 153, 210, 155 R, 168, 100; 404/103; 47/1.1, 18, 58.1 R, 58.1 FV, FOR. 100, DIG. 10
See application file for complete search history.

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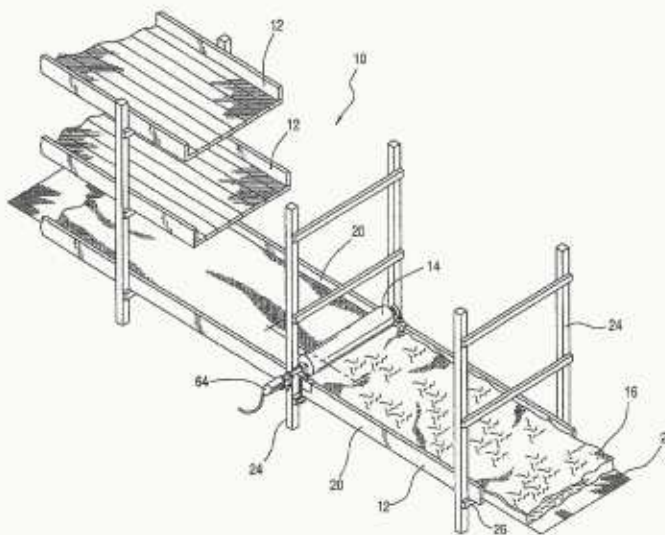
Primary Examiner — T. Nguyen

(74) *Attorney, Agent, or Firm* — Connolly Bove Lodge & Hutz LLP

(57) **ABSTRACT**

A mushroom compost compacting system and method includes a roller assembly mounted to a compost receptacle to form a nip, and a web or conveyor to convey mushroom compost to the nip. Mushroom compost is compacted at the nip from an initial compost height to a final compost height. The roller assembly has a roller, a shaft, and fixtures coupled to each end of the shaft. The fixtures are adjustable to define the roller nip height. In one embodiment, the fixtures are mounted to sleeves that engage the sidewalls of the compost receptacle. In another embodiment, the ends of the fixtures are mounted to a support, which may be a joist or a separate channel extending under the floor portion of the compost receptacle, or which may be a post that forms support structure for the compost receptacle.

5 Claims, 4 Drawing Sheets

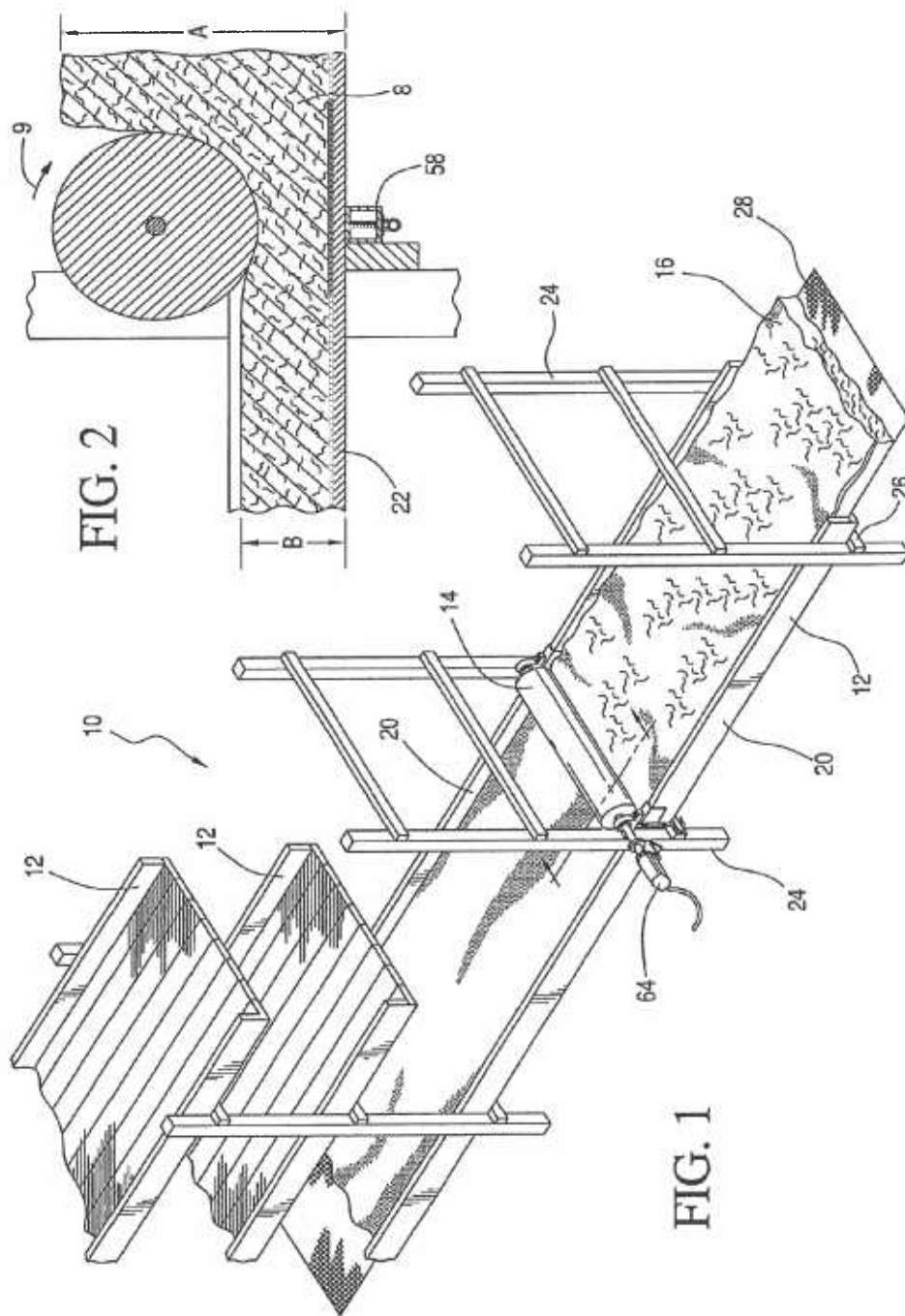


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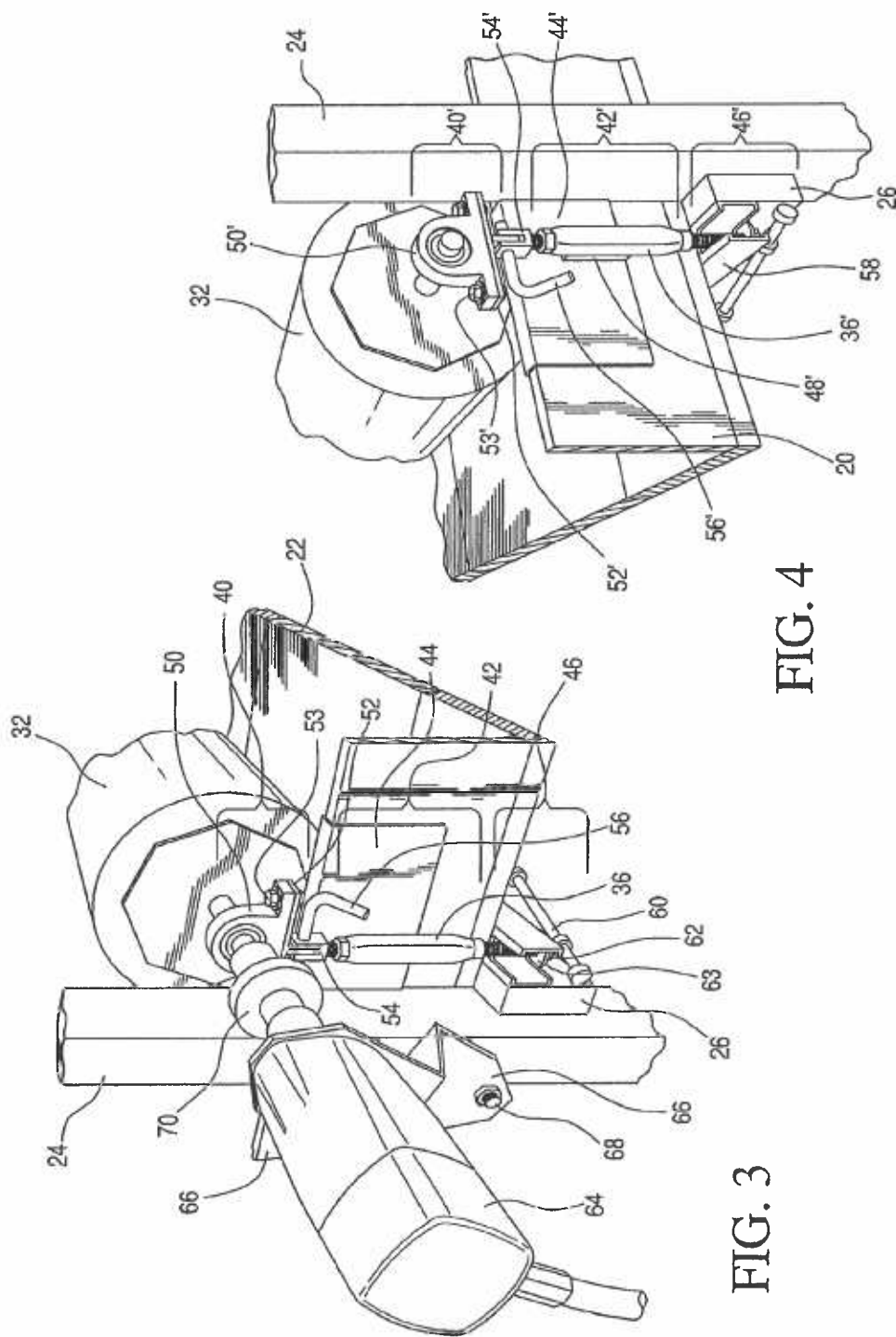


FIG. 3

FIG. 4

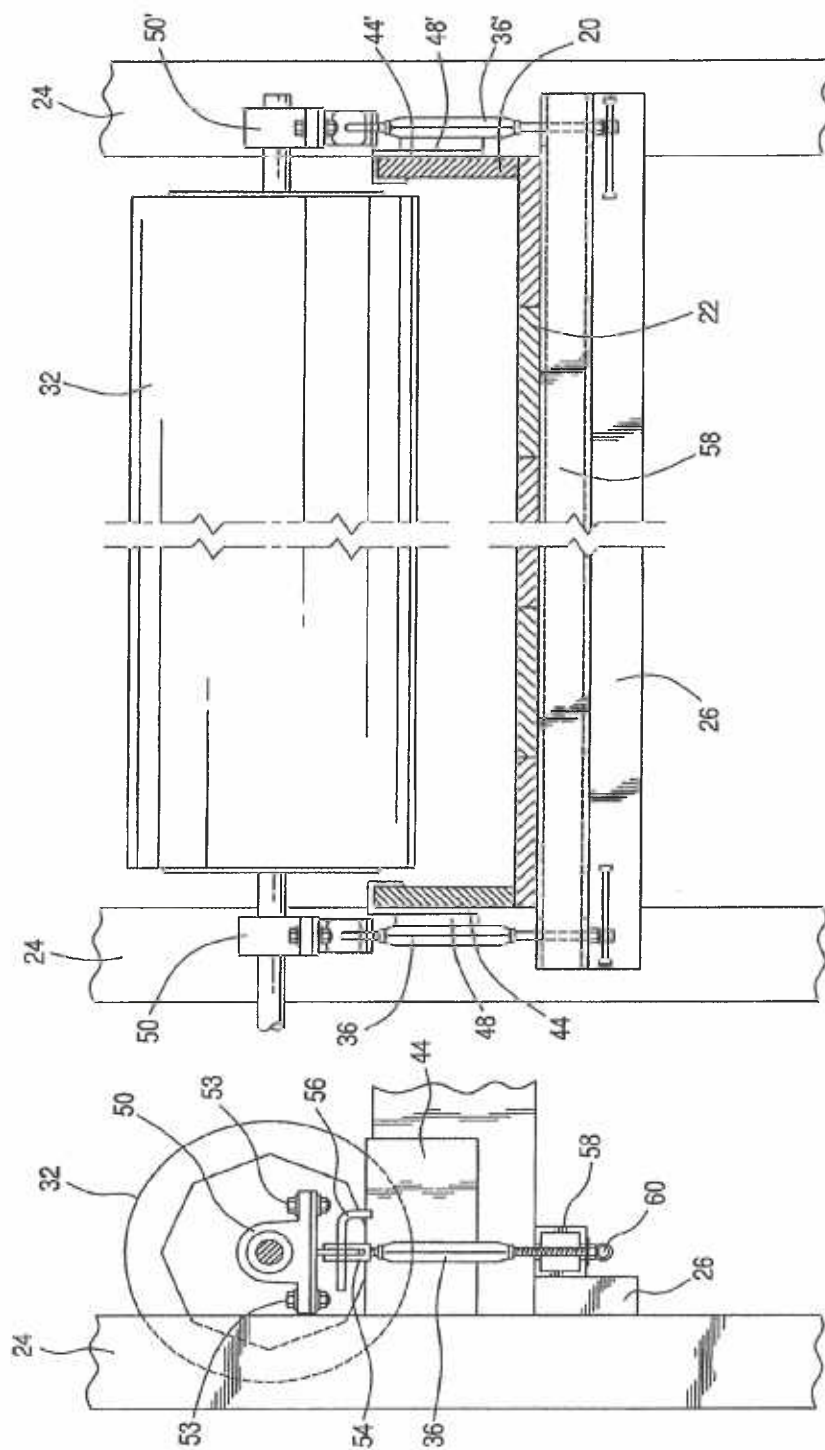


FIG. 6

FIG. 5

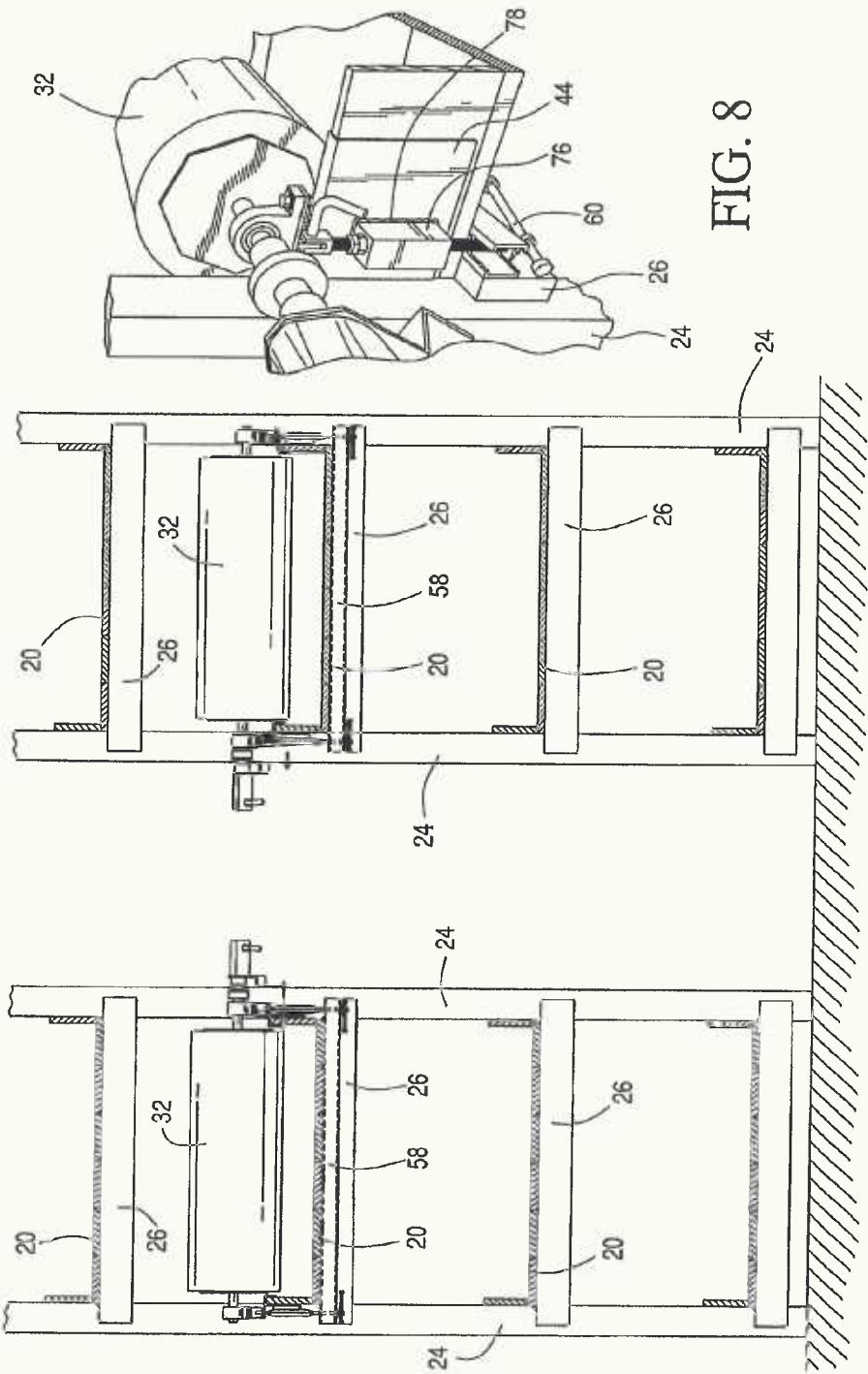


FIG. 8

FIG. 7

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**MUSHROOM COMPOST COMPACTING
SYSTEM AND METHOD****CROSS-REFERENCE TO RELATED
APPLICATION**

This application is a divisional of U.S. Ser. No. 12/902,523, filed Oct. 12, 2010, now U.S. Pat. No. 8,069,608.

BACKGROUND OF THE INVENTION**1. Field of the Invention**

The field of the invention is mushroom compost compacting systems, and particularly those systems for composting Phase II or Phase III mushroom composts.

2. Background

Mushroom farming comprises generally six steps: (1) Phase I composting; (2) Phase II composting; (3) spawning; or (2a/3a) Phase III composting; (4) casing; (5) pinning; and (6) cropping. The most used and least expensive mushroom compost is straw-bedded horse manure to which nitrogen supplements and a conditioning agent, such as gypsum, are added. After the compost ingredients have been mixed, watered and aerated in Phase I for a requisite number of days, the compost is pasteurized in Phase II. Pasteurization kills insects, unwanted fungi or other pests that may be present in the compost.

Preparing Phase II mushroom compost can be difficult. One reason for the apparent difficulty with this phase is that pasteurization can last up to two weeks, depending upon the production system used. The time required, as well as other difficulties in maintaining temperature control and eliminating pests during this phase have led many mushroom farmers to purchase pre-pasteurized compost. In many cases, the Phase II compost is pre-mixed with mushroom spawn. Alternatively, Phase III compost is pasteurized, pre-mixed with mushroom spawn and spawn run.

When commercial mushroom farmers purchase pre-pasteurized Phase II or Phase III composts, proper compaction of mushroom beds is still necessary to spawn and grow mushrooms. Moreover, regardless the type of receptacle in which the compost is stored during processing, uniform compaction and density of the compost is beneficial for mushroom cultivation. For maximum yield, mushroom beds should have Phase II and Phase III compost density and compaction that fosters gas exchange, keeps compost temperatures sufficiently low, and prevents spawn kill in the next phase of processing.

Presently, commercial mushroom farmers who purchase pre-pasteurized compost introduce the Phase II or Phase III compost into beds by conveyor and attempt to use spawning machines to compact the compost. These machines, however, are not designed to compact to the degree desired for mushroom cultivation. Furthermore, these machines are less than desirable for commercial mushroom farmers because during operation they also chop up the spawn incorporated into the compost, potentially interfering with the next step in mushroom farming.

Other known compacting systems and methods are impractical for commercial use. One such system uses an assembly with rollers and smoothing plates. In this system, mushroom compost is partially compacted after placement into the mushroom bed. The assembly is then horizontally positioned over the bed and manually guided by two operators located on each side of the bed. This system tends to compact only a surface layer portion of the bed. Compaction to some degree has also been performed by hand after place-

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ment of compost in the bed. These time-consuming manual systems and methods make clear the need for improved mushroom compaction systems.

While certain aspects of prior art mushroom compacting systems have been discussed, aspects of these systems are in no way disclaimed and it is contemplated that the claimed invention may encompass one or more aspects of the prior art devices discussed herein.

SUMMARY OF THE INVENTION

The present invention is directed toward a mushroom compost compacting system and method. In one embodiment, the system comprises a roller assembly mounted to a compost receptacle, and a web, all of which are configured to compact mushroom compost from an initial compost height to a final compost height. The compost receptacle is configured to receive mushroom compost from any source.

The roller assembly includes a roller, a shaft, and two fixtures to removably mount or affix the roller and shaft to the compost receptacle. The roller is mounted for rotation on the shaft, such as by a through-hole for receiving the shaft. The fixtures are coupled to the shaft for height adjustment of the roller and the shaft in relation to the floor portion of the compost receptacle. Each fixture has (a) a first end that is coupled to one respective end of the shaft, (b) a mid-section that is coupled to a sleeve that seats over a sidewall of the compost receptacle, and (c) a second end that is adapted to mount to a support onto the compost receptacle. The sleeve that is coupled to the mid-section of the fixture is adapted to removably mount onto the sidewalls of the compost receptacle.

The web or liner or conveyor included in the mushroom compacting system is adapted to move under the roller to convey compost to the nip. As the web or liner or conveyor moves under the roller, the mushroom compost is compacted from an initial compost height to a final desired compost height.

Accordingly, a mushroom compacting system and method are disclosed. Advantages of the system and method will appear from the drawings and following description.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention described above will be explained in greater detail below on the basis of embodiments and with reference to the accompanying drawings in which:

FIG. 1 is a top perspective view of a mushroom compost bed with a mushroom composting system;

FIG. 2 is a cross-sectional view of the mushroom composting system shown in FIG. 1 taken along line 2-2 in FIG. 1;

FIG. 3 is a left side partial perspective view of a roller assembly;

FIG. 4 is a right side partial perspective view of the roller assembly of FIG. 3;

FIG. 5 is a right side view of the roller assembly;

FIG. 6 is a broken front elevation view of the roller assembly;

FIG. 7 is a right side view of two roller assemblies operably attached to two mushroom compost beds; and

FIG. 8 is a right side view of an alternative fixture for a roller assembly.

**DETAILED DESCRIPTION OF THE PREFERRED
EMBODIMENTS**

Turning in detail to the drawings, FIG. 1. illustrates a mushroom compost bed 10 that includes a series of trays or

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shelves, herein compost receptacles 12, into each of which mushroom compost 8 is deposited or laid. The mushroom compost 8 may be Phase I, Phase II or Phase III compost. Phase II compost may be pre-spawned, and Phase III compost may be spawn run. The compost receptacle 12 may be any geometric configuration suitable to house mushroom compost 8. In one configuration as shown in FIG. 1, the compost receptacle 12 is an elongated bin, tray, or shelf that has two endwalls 18 (not shown), two sidewalls 20, and a bottom 22. The bottom may be a series of slats or decking running generally lengthwise. Each compost receptacle 12 is supported by vertical posts or members 24 positioned at each corner of the compost receptacle 12 and optionally at intervals along the length of the compost receptacle 12. The vertical posts or members 24 may act as supporting legs for one or more compost receptacles 12. As shown in FIG. 1, the vertical posts or members 24 extend vertically to support other compost receptacles (three tiers shown in FIG. 1). These types of multi-tiered compost receptacles are typical in commercial mushroom farming. For additional support, some compost receptacles also have horizontal members or joists 26 that may be mounted to or connected to the vertical members 24 and extend under the floor portion of the compost receptacle 12. Typically, the compost receptacles 12 are wooden, although any suitable material may be used, including, but not limited to plastic, metal, and composite materials.

The mushroom compost 8 is initially placed into the compost receptacle 12 from any suitable source. Preferably, the mushroom compost 8 is distributed inside the compost receptacle 12 along the length of the compost receptacle using a conveyor system (not shown) that acts on the web or conveyor or liner 28. In one type of conveyor system, at one end of the compost receptacle 12, compost is placed on top of the flexible web or conveyor or liner 28 in the bottom 22 of the compost receptacle 12 at a proximal end thereof. The liner 28 is then pulled from the opposite distal end of the compost receptacle 12, such that the compost 8 is distributed or spread along the length of the compost receptacle 12. Examples of suitable materials for the liner include woven fabrics with a plastic or Teflon coating, or may be polyester.

A mushroom compost compacting system 11 includes a roller assembly 14 that is removably affixed to the compost receptacle 12. Each roller assembly 14 comprises a roller 32, a shaft 34, and two fixtures 36, 36'. The shaft 34 and roller 32 extend laterally over the tray portion of the compost receptacle 12. The roller 32 may be made from a lightweight material such as plastic or aluminum, or may be made of another metal lined on its outer surface with a nylon or Teflon or other sheeting. The roller surface is smooth such that the mushroom compost to be compacted by the roller may move easily under the roller 32. In one embodiment, the diameter of roller 32 is from about 8 to 20 inches. The shaft 34 may be formed of steel; however, any material suitable to support the weight of the roller 32 may be used.

As shown in FIGS. 3, 5 and 6, the first fixture 36 includes a first end 40, a mid-section 42 coupled to a sleeve 44, and a second end 46. The first fixture 36 is coupled at one end 40 to one shaft end 38 at pillow block bearing 50 and is coupled at the opposite end 62 to a support 58, such as a channel member. The pillow block bearing 50 is then mounted onto a mounting bracket or plate 52, using bolts 53 or other suitable fasteners. The mounting bracket or plate 52 is then welded to a first mounting element 54 which is threaded to the mid-section 42. Disposed within the first mounting element 54 is a pin 56 which may be rotated for adjustment of the first end 40, such that height adjustment of the roller 32 and shaft 34 is possible for compaction of the mushroom compost. As an

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example, the nip height between the outer circumferential surface of the roller and the floor of the compost receptacle may be from about 2 to about 8 inches. The nip height is set at a distance that is less than the desired compacted height of the mushroom compost.

The mid-section 42 of first fixture 36 may be joined by a spacer 48 or may be welded to a sleeve 44 that is removably mounted or seated or engaged onto a first sidewall 20 of the compost receptacle 12. The second end 42 of the first fixture 36 is threaded to engage the mid-section 42 and to mount onto the compost receptacle 12. Preferably, the second end or opposite end of the first fixture 36 is joined to or mounted to a support, such as channel member 58, that abuts joist or horizontal member 26. In one embodiment, the channel member 58 is a square hollow pipe with a length sufficient to extend under the compost receptacle, and the dimensions of such square may be from 2 inches to 6 inches. In another embodiment, the support may also comprise a solid pipe of suitable cross-sectional shape as desired. The second end 46 is further coupled to a handle element 60 to allow for adjustment of the second end 46. For additional adjustment of the second end 42, washer(s) 63 may be placed between the channel member 58 and the handle element 60.

Referring next to FIGS. 4 and 6, the second fixture 36' may be joined by spacer 48' or may be welded to a sleeve 44'. The second fixture 36' is coupled at one end 40' to one shaft end 38' at pillow block bearing 50' and is coupled at the opposite end 62' to a support 58, such as a channel member. The pillow block bearing 50' is then mounted onto a mounting bracket or plate 52', using bolts 53 or other suitable fasteners. The plate 52' is then welded to a first mounting element 54' which is threaded to the mid-section 42'. Disposed within the first mounting element 54' is a pin 56' which may be rotated for adjustment of the first end 40'.

In an alternative embodiment, however, the second end of the first fixture 36 and the second end of the second fixture 36' are mounted directly to the compost receptacle 12, such as to post 24 or to joist 26 (not shown).

The roller shaft may be turned by hand. Preferably, the first end of the shaft 34 is coupled to a motor 64 for rotation of the roller 32. As shown in FIG. 3, the motor 64 is mounted to a vertical post 24 of the compost receptacle 12 using a mounting plate 66. Adjustment of the mounting plate 66 is achieved through use of a pin 68 that is threaded to the mounting plate 66. Suitable motors include electric and hydraulic motors rated at 1 to 5 HP, or higher HP, although any motor with sufficient capacity to rotate shaft 34 may be used.

The first and second fixtures 36, 36' may be formed from shaped metal, such as steel; however, other materials with sufficient strength to support the roller 32 and shaft 34 may be used.

Once installed, the mushroom compacting system 11 compacts mushroom compost from a first height A to a compacted height B as illustrated in FIG. 2. Gauge boards (not shown) can be inserted adjacent to the side walls of the compost receptacle 12 to help workers place a quantity of mushroom compost onto the conveyor, web or liner 28 at a desired height at one end of the compost receptacle. The roller 32 is rotated in the direction of arrow 9 and the conveyor, web or liner 28 conveys mushroom compost laid thereon to the nip between the roller 32 and the floor portion of the compost receptacle 12. The mushroom compost compacting system 11 can be used with pre-spawned Phase II compost or spawn run Phase III compost without adversely impacting the mushroom crop. As one example, the height A may be about 15 to 16 inches and the height B may be about 6 to 9 inches. A successful degree of compaction is determined at the mushroom grow-

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er's discretion. The mushroom compacting system 11 provides means to obtain a more uniform compaction of the mushroom compost at the top, middle and bottom portions of the compacted compost bed.

Upon completing compaction of compost to a desired thickness within a first bin or tray of a mushroom compost bed 10, the mushroom compacting system 11 may be detached from the sidewalls 20 of the compost receptacle 12 and attached to another bin or tray.

As shown in FIG. 7, the mushroom compacting system 11 can include multiple roller assemblies 14 operating concurrently on separate trays or shelves or compost receptacles 12 of one or more compost beds 10, 10'. Each roller assembly 14 is portable, and may be easily disassembled and re-installed to other areas along the length of a compost receptacle 12 or to other trays positioned above or below a first compost receptacle 12 of a compost bed 10. Compost beds may include six or seven compost receptacles 12 mounted in stacked relation. After a lower compost receptacle is prepared and compacted, the next highest compost receptacle may be installed and prepared and compacted for growing mushrooms.

An alternative construction of a fixture 76 is shown in FIG. 8. The fixture 76 is welded at weld seam 78 to the sleeve 44. The fixture 76 may be formed with thicker sidewalls than the fixtures 36, 36' in FIGS. 1-7, and has a generally square configuration in cross-section.

A properly compacted mushroom compost bed using the mushroom compacting system according to the invention can shorten the mushroom grow time cycle by one or two days. The system not only expedites mushroom bed preparation with Phase II or Phase III compost, but also produces a more consistent compost compaction that can lead to enhanced yield in a shorter grow time cycle.

While embodiments of this invention have been shown and described, it will be apparent to those skilled in the art that many more modifications are possible without departing from the inventive concepts herein. The invention, therefore, is not to be restricted except in the spirit of the following claims.

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What is claimed is:

1. A method for compacting mushroom compost, comprising:
 - introducing a quantity of mushroom compost onto a web that is disposed over a floor portion of a mushroom compost receptacle and traversable into a nip formed between a roller and the floor portion of the mushroom compost receptacle, wherein the roller is adapted for rotation about a shaft, a first fixture is coupled to a first end of the shaft, wherein the first fixture is adapted for height adjustment of the roller and the shaft in reference to the floor portion of the compost receptacle to create the nip between the roller and the floor portion of the compost receptacle, wherein the first fixture comprises:
 - a first end coupled to the first end of the shaft,
 - a mid-section coupled to a sleeve, wherein the sleeve is adapted to mount onto a first sidewall of the compost receptacle, and
 - a second end adapted to mount onto a support of the compost receptacle; and
 - a second fixture coupled to a second end of the shaft, wherein the second fixture is adapted for height adjustment of the roller and the shaft in reference to the floor portion of the compost receptacle, wherein the second fixture comprises:
 - a first end coupled to the second end of the shaft;
 - a mid-section coupled to a second sleeve, wherein the second sleeve is adapted to mount onto a second sidewall of the compost receptacle, and
 - a second end adapted to mount onto the support of the compost receptacle;
 - conveying the web and quantity of mushroom compost through the nip; and
 - rotating the roller to compress the mushroom compost.
2. The method of claim 1, wherein the support is a channel member positioned under the floor portion of the compost receptacle, and coupled to the second end of the fixture.
3. The method of claim 1, wherein the support is a joist supporting the floor portion of the compost receptacle.
4. The method of claim 1, wherein the roller is rotated with a motor coupled to a roller shaft.
5. The method of claim 1, wherein the quantity of mushroom compost introduced onto the web is at a height of about 15 to 16 inches, and following compaction at the nip, the mushroom compost is at a height of about 6 to 9 inches.

* * * * *

Exhibit C



US008561344B2

(12) **United States Patent**
Pannell

(10) **Patent No.:** **US 8,561,344 B2**

(45) **Date of Patent:** ***Oct. 22, 2013**

(54) **MUSHROOM COMPOST COMPACTING SYSTEM AND METHOD**

47/DIG. 10; 100/152, 102, 153, 210, 155 R,
100/168, 100; 404/103

See application file for complete search history.

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patent is extended or adjusted under 35
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This patent is subject to a terminal dis-
claimer.

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application No. 13/309,071, filed on Dec. 1, 2011, now
Pat. No. 8,205,379, which is a division of application
No. 12/902,523, filed on Oct. 12, 2010, now Pat. No.
8,069,608.

(51) Int. Cl.
A01G 1/04 (2006.01)

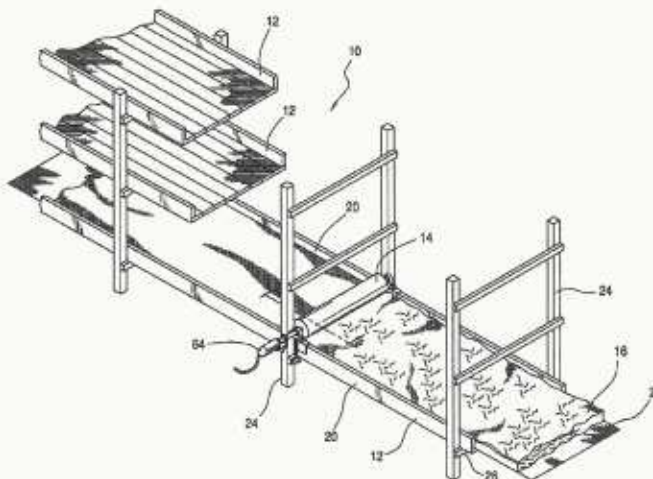
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USPC 47/1.1, 18, 58.1 R, 58.1 FV, FOR. 100,

ABSTRACT

A mushroom compost compacting system and method includes a roller assembly mounted to a compost receptacle to form a nip, and a web or conveyor to convey mushroom compost to the nip. Mushroom compost is compacted at the nip from an initial compost height to a final compost height. The roller assembly has a roller, a shaft, and fixtures coupled to each end of the shaft. The fixtures are adjustable to define the roller nip height. In one embodiment, the fixtures are mounted to sleeves that engage the sidewalls of the compost receptacle. In another embodiment, the ends of the fixtures are mounted to a support, which may be a joist or a separate channel extending under the floor portion of the compost receptacle, or which may be a post that forms support structure for the compost receptacle.

10 Claims, 4 Drawing Sheets



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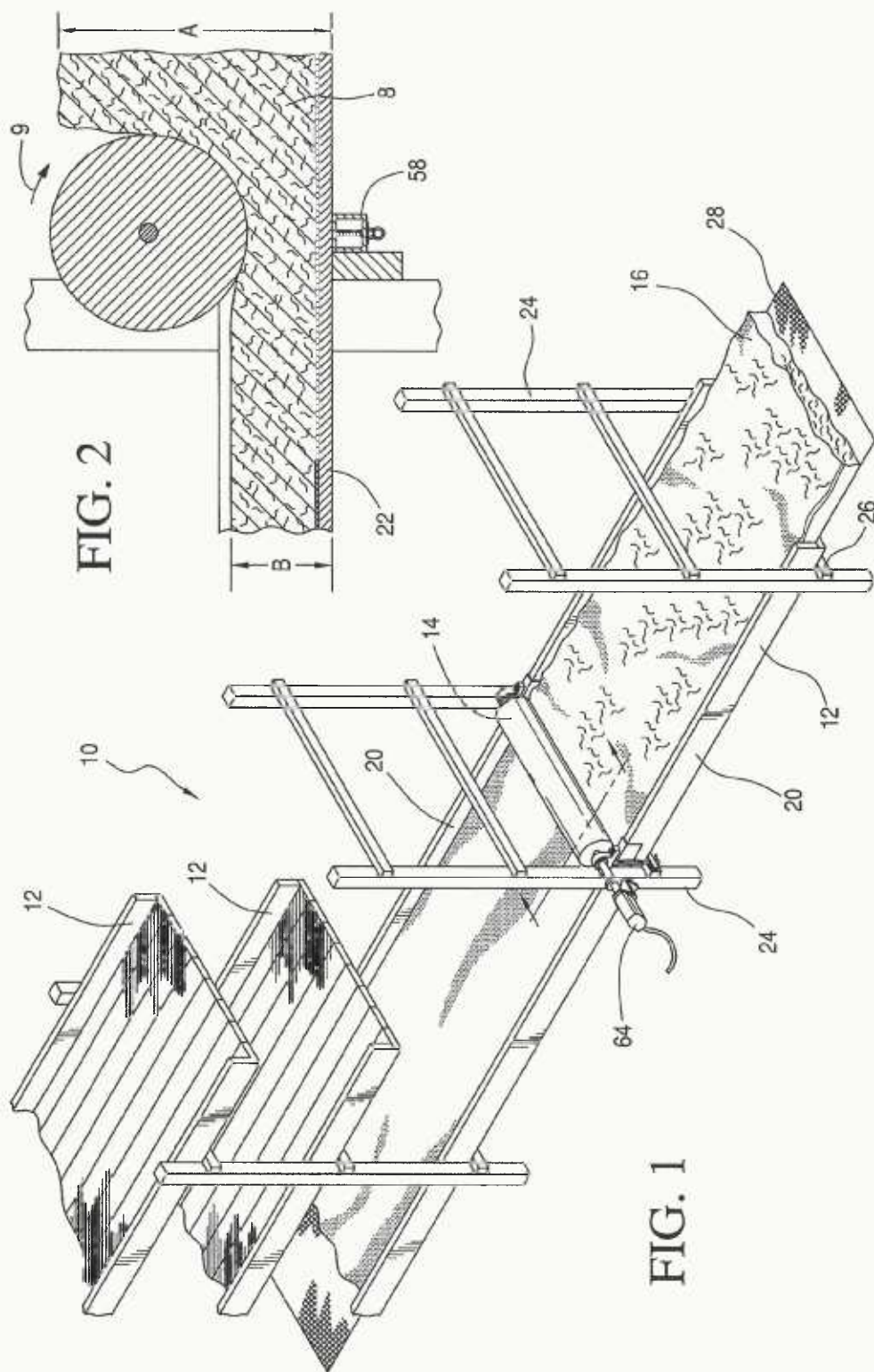
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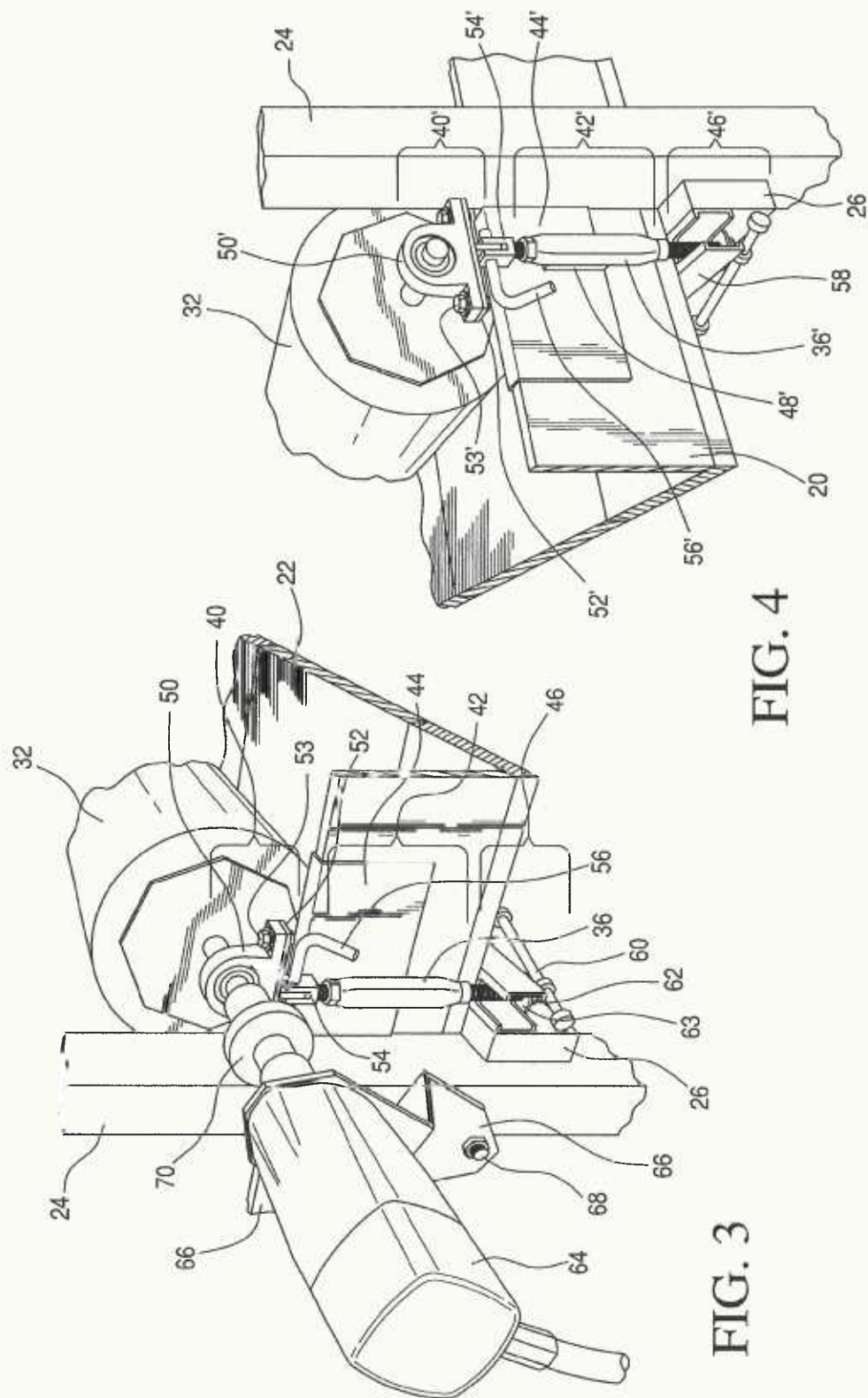


FIG. 4

FIG. 3

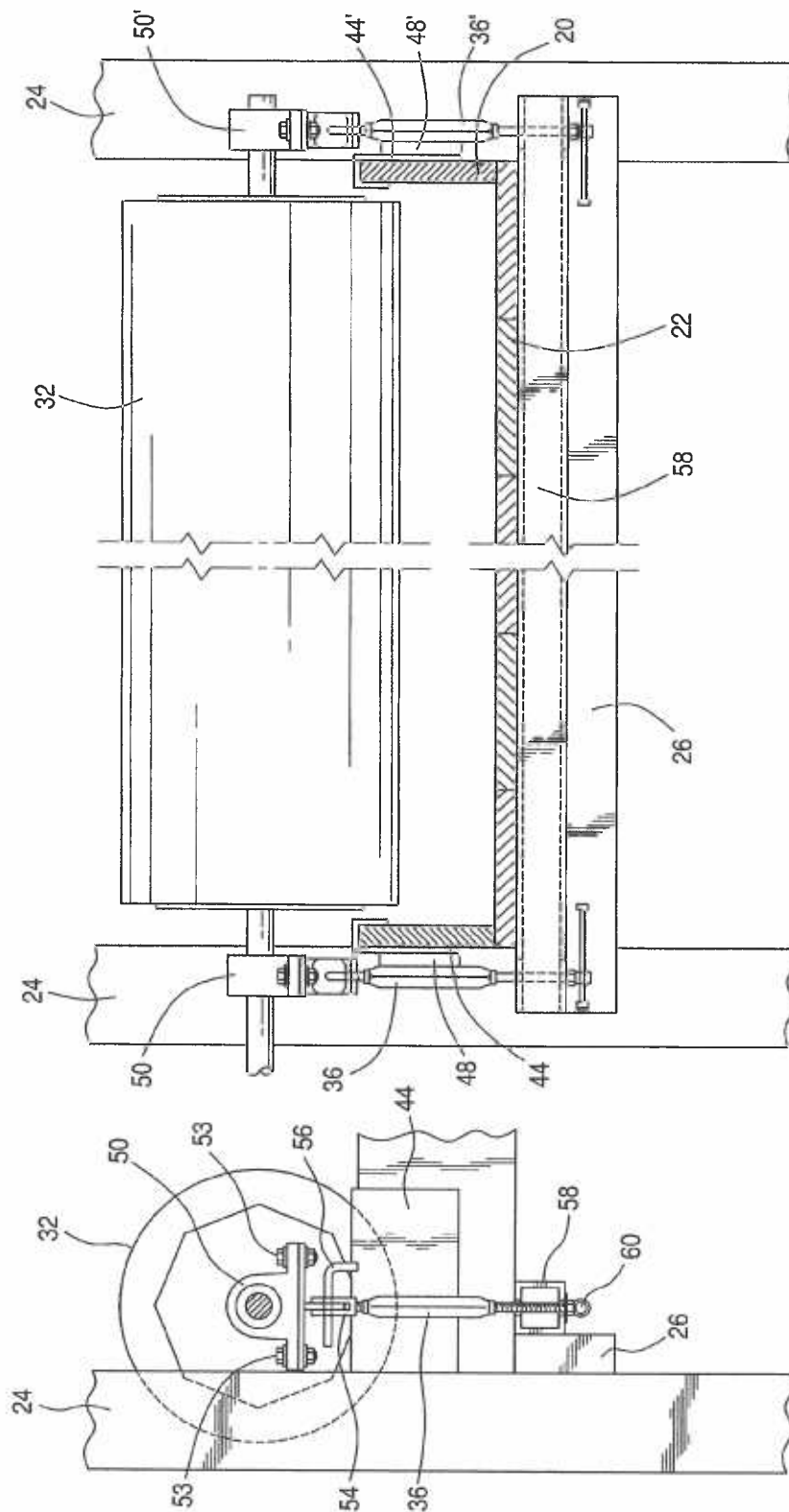


FIG. 6

FIG. 5

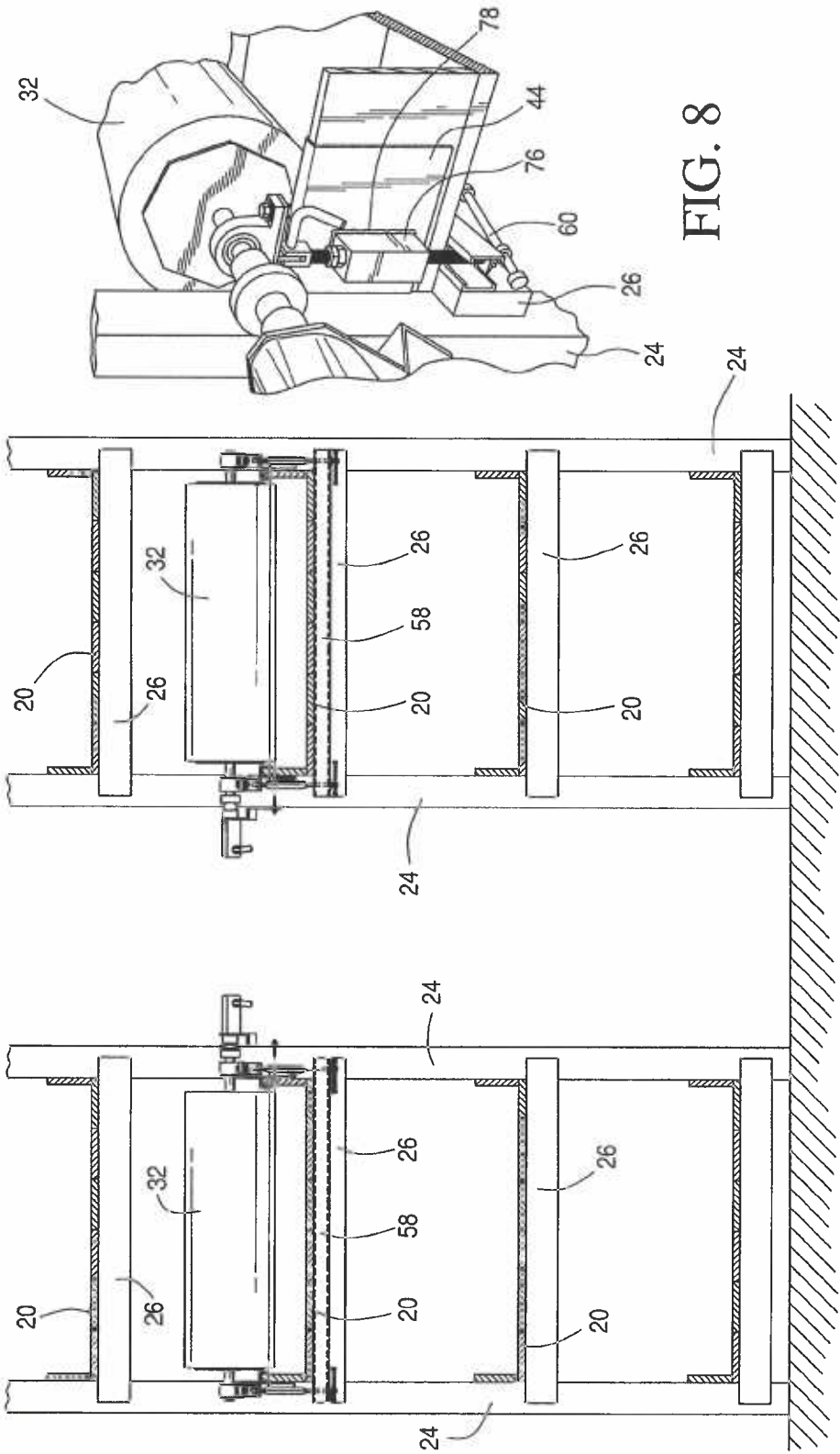


FIG. 8

FIG. 7

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**MUSHROOM COMPOST COMPACTING
SYSTEM AND METHOD****CROSS-REFERENCE TO RELATED
APPLICATIONS**

This application is a continuation of U.S. Ser. No. 13/438, 909, filed Apr. 4, 2012, now pending, which was a divisional of U.S. Ser. No. 13,309,071, filed Dec. 1, 2011, now U.S. Pat. No. 8,205,379, which was a divisional of U.S. Ser. No. 12/902,523, filed Oct. 12, 2010, now U.S. Pat. No. 8,069,608.

BACKGROUND OF THE INVENTION**1. Field of the Invention**

The field of the invention is mushroom compost compacting systems, and particularly those systems for composting Phase II or Phase III mushroom composts.

2. Background

Mushroom farming comprises generally six steps: (1) Phase I composting; (2) Phase II composting; (3) spawning; or (2a/3a) Phase III composting; (4) casing; (5) pinning; and (6) cropping. The most used and least expensive mushroom compost is straw-bedded horse manure to which nitrogen supplements and a conditioning agent, such as gypsum, are added. After the compost ingredients have been mixed, watered and aerated in Phase I for a requisite number of days, the compost is pasteurized in Phase II. Pasteurization kills insects, unwanted fungi or other pests that may be present in the compost.

Preparing Phase II mushroom compost can be difficult. One reason for the apparent difficulty with this phase is that pasteurization can last up to two weeks, depending upon the production system used. The time required, as well as other difficulties in maintaining temperature control and eliminating pests during this phase have led many mushroom farmers to purchase pre-pasteurized compost. In many cases, the Phase II compost is pre-mixed with mushroom spawn. Alternatively, Phase III compost is pasteurized, pre-mixed with mushroom spawn and spawn run.

When commercial mushroom farmers purchase pre-pasteurized Phase II or Phase III composts, proper compaction of mushroom beds is still necessary to spawn and grow mushrooms. Moreover, regardless the type of receptacle in which the compost is stored during processing, uniform compaction and density of the compost is beneficial for mushroom cultivation. For maximum yield, mushroom beds should have Phase II and Phase III compost density and compaction that fosters gas exchange, keeps compost temperatures sufficiently low, and prevents spawn kill in the next phase of processing.

Presently, commercial mushroom farmers who purchase pre-pasteurized compost introduce the Phase II or Phase III compost into beds by conveyor and attempt to use spawning machines to compact the compost. These machines, however, are not designed to compact to the degree desired for mushroom cultivation. Furthermore, these machines are less than desirable for commercial mushroom farmers because during operation they also chop up the spawn incorporated into the compost, potentially interfering with the next step in mushroom farming.

Other known compacting systems and methods are impractical for commercial use. One such system uses an assembly with rollers and smoothing plates. In this system, mushroom compost is partially compacted after placement into the mushroom bed. The assembly is then horizontally positioned over the bed and manually guided by two opera-

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tors located on each side of the bed. This system tends to compact only a surface layer portion of the bed. Compaction to some degree has also been performed by hand after placement of compost in the bed. These time-consuming manual systems and methods make clear the need for improved mushroom compaction systems.

While certain aspects of prior art mushroom compacting systems have been discussed, aspects of these systems are in no way disclaimed and it is contemplated that the claimed invention may encompass one or more aspects of the prior art devices discussed herein.

SUMMARY OF THE INVENTION

The present invention is directed toward a mushroom compost compacting system and method. In one embodiment, the system comprises a roller assembly mounted to a compost receptacle, and a web, all of which are configured to compact mushroom compost from an initial compost height to a final compost height. The compost receptacle is configured to receive mushroom compost from any source.

The roller assembly includes a roller, a shaft, and two fixtures to removably mount or affix the roller and shaft to the compost receptacle. The roller is mounted for rotation on the shaft, such as by a through-hole for receiving the shaft. The fixtures are coupled to the shaft for height adjustment of the roller and the shaft in relation to the floor portion of the compost receptacle. Each fixture has (a) a first end that is coupled to one respective end of the shaft, (b) a mid-section that is coupled to a sleeve that seats over a sidewall of the compost receptacle, and (c) a second end that is adapted to mount to a support onto the compost receptacle. The sleeve that is coupled to the mid-section of the fixture is adapted to removably mount onto the sidewalls of the compost receptacle.

The web or liner or conveyor included in the mushroom compacting system is adapted to move under the roller to convey compost to the nip. As the web or liner or conveyor moves under the roller, the mushroom compost is compacted from an initial compost height to a final desired compost height.

Accordingly, a mushroom compacting system and method are disclosed. Advantages of the system and method will appear from the drawings and following description.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention described above will be explained in greater detail below on the basis of embodiments and with reference to the accompanying drawings in which:

FIG. 1 is a top perspective view of a mushroom compost bed with a mushroom composting system;

FIG. 2 is a cross-sectional view of the mushroom composting system shown in FIG. 1 taken along line 2-2 in FIG. 1;

FIG. 3 is a left side partial perspective view of a roller assembly;

FIG. 4 is a right side partial perspective view of the roller assembly of FIG. 3;

FIG. 5 is a right side view of the roller assembly;

FIG. 6 is a broken front elevation view of the roller assembly;

FIG. 7 is a right side view of two roller assemblies operably attached to two mushroom compost beds; and

FIG. 8 is a right side view of an alternative fixture for a roller assembly.

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DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Turning in detail to the drawings, FIG. 1 illustrates a mushroom compost bed 10 that includes a series of trays or shelves, herein compost receptacles 12, into each of which mushroom compost 8 is deposited or laid. The mushroom compost 8 may be Phase I, Phase II or Phase III compost. Phase II compost may be pre-spawned, and Phase III compost may be spawn run. The compost receptacle 12 may be any geometric configuration suitable to house mushroom compost 8. In one configuration as shown in FIG. 1, the compost receptacle 12 is an elongated bin, tray, or shelf that has two endwalls 18 (not shown), two sidewalls 20, and a bottom 22. The bottom may be a series of slats or decking running generally lengthwise. Each compost receptacle 12 is supported by vertical posts or members 24 positioned at each corner of the compost receptacle 12 and optionally at intervals along the length of the compost receptacle 12. The vertical posts or members 24 may act as supporting legs for one or more compost receptacles 12. As shown in FIG. 1, the vertical posts or members 24 extend vertically to support other compost receptacles (three tiers shown in FIG. 1). These types of multi-tiered compost receptacles are typical in commercial mushroom farming. For additional support, some compost receptacles also have horizontal members or joists 26 that may be mounted to or connected to the vertical members 24 and extend under the floor portion of the compost receptacle 12. Typically, the compost receptacles 12 are wooden, although any suitable material may be used, including, but not limited to plastic, metal, and composite materials.

The mushroom compost 8 is initially placed into the compost receptacle 12 from any suitable source. Preferably, the mushroom compost 8 is distributed inside the compost receptacle 12 along the length of the compost receptacle using a conveyor system (not shown) that acts on the web or conveyor or liner 28. In one type of conveyor system, at one end of the compost receptacle 12, compost is placed on top of the flexible web or conveyor or liner 28 in the bottom 22 of the compost receptacle 12 at a proximal end thereof. The liner 28 is then pulled from the opposite distal end of the compost receptacle 12, such that the compost 8 is distributed or spread along the length of the compost receptacle 12. Examples of suitable materials for the liner include woven fabrics with a plastic or Teflon coating, or may be polyester.

A mushroom compost compacting system 11 includes a roller assembly 14 that is removably affixed to the compost receptacle 12. Each roller assembly 14 comprises a roller 32, a shaft 34, and two fixtures 36, 36'. The shaft 34 and roller 32 extend laterally over the tray portion of the compost receptacle 12. The roller 32 may be made from a lightweight material such as plastic or aluminum, or may be made of another metal lined on its outer surface with a nylon or Teflon or other sheeting. The roller surface is smooth such that the mushroom compost to be compacted by the roller may move easily under the roller 32. In one embodiment, the diameter of roller 32 is from about 8 to 20 inches. The shaft 34 may be formed of steel; however, any material suitable to support the weight of the roller 32 may be used.

As shown in FIGS. 3, 5 and 6, the first fixture 36 includes a first end 40, a mid-section 42 coupled to a sleeve 44, and a second end 46. The first fixture 36 is coupled at one end 40 to one shaft end 38 at pillow block bearing 50 and is coupled at the opposite end 46 to a support 58, such as a channel member. The pillow block bearing 50 is then mounted onto a mounting bracket or plate 52, using bolts 53 or other suitable fasteners. The mounting bracket or plate 52 is then welded to

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a first mounting element 54 which is threaded to the mid-section 42. Disposed within the first mounting element 54 is a pin 56 which may be rotated for adjustment of the first end 40, such that height adjustment of the roller 32 and shaft 34 is possible for compaction of the mushroom compost. As an example, the nip height between the outer circumferential surface of the roller and the floor of the compost receptacle may be from about 2 to about 8 inches. The nip height is set at a distance that is less than the desired compacted height of the mushroom compost.

The mid-section 42 of first fixture 36 may be joined by a spacer 48 or may be welded to a sleeve 44 that is removably mounted or seated or engaged onto a first sidewall 20 of the compost receptacle 12. The second end 46 of the first fixture 36 is threaded to engage the mid-section 42 and to mount onto the compost receptacle 12. Preferably, the second end or opposite end of the first fixture 36 is joined to or mounted to a support, such as channel member 58, that abuts joist or horizontal member 26. In one embodiment, the channel member 58 is a square hollow pipe with a length sufficient to extend under the compost receptacle, and the dimensions of such square may be from 2 inches to 6 inches. In another embodiment, the support may also comprise a solid pipe of suitable cross-sectional shape as desired. The second end 46 is further coupled to a handle element 60 to allow for adjustment of the second end 46. For additional adjustment of the second end 42, washer(s) 63 may be placed between the channel member 58 and the handle element 60.

Referring next to FIGS. 4 and 6, the second fixture 36' may be joined by spacer 48' or may be welded to a sleeve 44'. The second fixture 36' is coupled at one end 40' to one shaft end 38 at pillow block bearing 50' and is coupled at the opposite end 46' to a support 58, such as a channel member. The pillow block bearing 50' is then mounted onto a mounting bracket or plate 52', using bolts 53 or other suitable fasteners. The plate 52' is then welded to a first mounting element 54' which is threaded to the mid-section 42'. Disposed within the first mounting element 54' is a pin 56' which may be rotated for adjustment of the first end 40'.

In an alternative embodiment, however, the second end of the first fixture 36 and the second end of the second fixture 36' are mounted directly to the compost receptacle 12, such as to post 24 or to joist 26 (not shown).

The roller shaft may be turned by hand. Preferably, the first end of the shaft 34 is coupled to a motor 64 for rotation of the roller 32. As shown in FIG. 3, the motor 64 is mounted to a vertical post 24 of the compost receptacle 12 using a mounting plate 66. Adjustment of the mounting plate 66 is achieved through use of a pin 68 that is threaded to the mounting plate 66. Suitable motors include electric and hydraulic motors rated at 1 to 5 HP, or higher HP, although any motor with sufficient capacity to rotate shaft 34 may be used.

The first and second fixtures 36, 36' may be formed from shaped metal, such as steel; however, other materials with sufficient strength to support the roller 32 and shaft 34 may be used.

Once installed, the mushroom compacting system 11 compacts mushroom compost from a first height A to a compacted height B as illustrated in FIG. 2. Gauge boards (not shown) can be inserted adjacent to the side walls of the compost receptacle 12 to help workers place a quantity of mushroom compost onto the conveyor, web or liner 28 at a desired height at one end of the compost receptacle. The roller 32 is rotated in the direction of arrow 9 and the conveyor, web or liner 28 conveys mushroom compost laid thereon to the nip between the roller 32 and the floor portion of the compost receptacle 12. The mushroom compost compacting system 11 can be

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used with pre-spawned Phase II compost or spawn run Phase III compost without adversely impacting the mushroom crop. As one example, the height A may be about 15 to 16 inches and the height B may be about 6 to 9 inches. A successful degree of compaction is determined at the mushroom grower's discretion. The mushroom compacting system 11 provides means to obtain a more uniform compaction of the mushroom compost at the top, middle and bottom portions of the compacted compost bed.

Upon completing compaction of compost to a desired thickness within a first bin or tray of a mushroom compost bed 10, the mushroom compacting system 11 may be detached from the sidewalls 20 of the compost receptacle 12 and attached to another bin or tray.

As shown in FIG. 7, the mushroom compacting system 11 can include multiple roller assemblies 14 operating concurrently on separate trays or shelves or compost receptacles 12 of one or more compost beds 10, 10'. Each roller assembly 14 is portable, and may be easily disassembled and re-installed to other areas along the length of a compost receptacle 12 or to other trays positioned above or below a first compost receptacle 12 of a compost bed 10. Compost beds may include six or seven compost receptacles 12 mounted in stacked relation. After a lower compost receptacle is prepared and compacted, the next highest compost receptacle may be installed and prepared and compacted for growing mushrooms.

An alternative construction of a fixture 76 is shown in FIG. 8. The fixture 76 is welded at weld seam 78 to the sleeve 44. The fixture 76 may be formed with thicker sidewalls than the fixtures 36, 36' in FIGS. 1-7, and has a generally square configuration in cross-section.

A properly compacted mushroom compost bed using the mushroom compacting system according to the invention can shorten the mushroom grow time cycle by one or two days. The system not only expedites mushroom bed preparation with Phase II or Phase III compost, but also produces a more consistent compost compaction that can lead to enhanced yield in a shorter grow time cycle.

While embodiments of this invention have been shown and described, it will be apparent to those skilled in the art that many more modifications are possible without departing from the inventive concepts herein. The invention, therefore, is not to be restricted except in the spirit of the following claims.

What is claimed is:

1. A mushroom compost compacting system, comprising: at least one roller assembly coupled to a compost receptacle at one fixed location along the length of the compost receptacle, said compost receptacle having mushroom compost therein, wherein the at least one roller assembly comprises:
 - a roller adapted for rotation on a shaft;
 - at least one first fixture coupled to a first end of the shaft, wherein the first fixture is adapted for height adjustment of the roller and the shaft in reference to a floor portion of the compost receptacle to create a nip between the roller and the floor portion of the compost receptacle;
 - at least one second fixture coupled to a second end of the shaft, wherein the second fixture is adapted for height

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adjustment of the roller and the shaft in reference to the floor portion of the compost receptacle; and

a web adapted to convey mushroom compost into the nip between the roller and the floor portion of the compost receptacle.

2. The mushroom compost compacting system of claim 1, further comprising a motor coupled to the shaft for rotation of the roller.

3. The mushroom compost compacting system of claim 1, wherein the first fixture comprises a mid-section coupled to a sleeve, wherein the sleeve is adapted to mount onto a support of the compost receptacle.

4. The mushroom compost compacting system of claim 1, wherein the second fixture comprises a mid-section coupled to a sleeve, wherein the sleeve is adapted to mount onto a support of the compost receptacle.

5. The mushroom compost compacting system of claim 1, wherein the first fixture has a first end coupled to the first end of the shaft and a second end adapted to mount onto the compost receptacle or a support thereof.

6. The mushroom compost compacting system of claim 1, wherein the second fixture has a first end coupled to the second end of the shaft and a second end adapted to mount onto the compost receptacle or a support thereof.

7. A portable roller assembly for compacting mushroom compost held in a compost receptacle, said compost receptacle having a length, comprising:

a roller adapted for rotation on a shaft;

at least one first fixture coupled to a first end of the shaft, wherein the first fixture is adapted for height adjustment of the roller and the shaft in reference to a floor portion of the compost receptacle having mushroom compost therein to create a nip between the roller and the floor portion of the compost receptacle for compacting the mushroom compost, with said at least one first fixture positioned at one fixed location along the length of the compost receptacle, and

at least one second fixture coupled to a second end of the shaft, wherein the second fixture is adapted for height adjustment of the roller and the shaft in reference to the floor portion of the compost receptacle, with said at least one second fixture positioned at or near the one fixed location along the length of the compost receptacle, wherein said portable roller assembly compacts mushroom compost as said mushroom compost is conveyed through the nip between the roller and the floor portion of the compost receptacle.

8. The roller assembly of claim 7, wherein the first fixture has a first end coupled to the first end of the shaft and a second end adapted to mount onto the compost receptacle or a support thereof.

9. The roller assembly of claim 7, wherein the second fixture has a first end coupled to the second end of the shaft and a second end adapted to mount onto the compost receptacle or a support thereof.

10. The roller assembly of claim 7, further comprising a motor coupled to the shaft for rotation of the roller.

* * * * *

Exhibit D

